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Shipping and the Railroads

THE past year has seen a very perceptible change in the attitude of this country, as a whole, towards its shipping. Just why the attention of the nation should be turned to its maritime interests at the present time it is rather difficult to say. The needs of our shipping in the overseas trade would seem to have been set forth with sufficient clearness for some years past, but in the main the arguments advanced in its behalf have apparently failed to "register" with a large proportion of the country's inhabitants. The object lessons furnished by the Boer War in the early days of this century, and more recently and in such overwhelming manner by the World War were forgotten practically as soon as peace returned but now, if one may judge by the attention it has been receiving in the daily press for the past few months, the nation is awakening to the fact that shipping is a national problem, that the ownership and control of shipping is important, even vital, to the nation's welfare and, most important of all, that if American commercial vessels are to continue in operation on the high seas, constructive action must immediately be undertaken—that words without works will not longer suffice as the national policy as regards the merchant marine.

Undoubtedly the government itself has largely contributed to bring about the present situation. The fact that Shipping Board vessels have carried grain and cotton at times when these crops would not otherwise have been moved at all, except at what appeared to be excessive freight rates, has brought home to the farmers of the middle west and south the knowledge that they have a very direct interest in shipping and its control by domestic rather than foreign interests and that, under certain circumstances and conditions, its welfare is a matter of vital moment to them. On the other hand there is, in a large section of the population, a distinct opposition to government ownership in and operation of commercial enterprises, which, when directed against its ownership and operation of vessels, at once brings out clearly the fact that without this ownership and operation American ships will very shortly disappear from foreign trade—unless some means is found by which government aid may be directly given to American ship operators and owners or laws are enacted which will make it possible for the great transportation and commercial organizations of the country to become interested in shipping to a far greater extent than has heretofore been possible.

It is doubtless some such ideas which have, in the past week or so, brought into prominence the question of the ownership and operation of overseas steamship lines by the great American railroads. The plan is by no means a new one for our domestic commerce is not wanting in examples of the efficiency and economy of unified control of railroads and ships. Furthermore, the Canadian Pacific Company offers a most outstanding example of economic strength and commercial success resulting from the unification and control of great railway and steamship lines.

In North America it is particularly true that the railroads are the principal feeders of the transoceanic lines, both east and west. That combinations should be made, offering through bills of lading to foreign ports, seems an entirely logical and natural development; one which could not fail to be of the greatest advantage to all shippers doing business with foreign countries.

That a combination of American railroads and steamship lines would ensure more business to the latter goes without saying; whether it would bring enough business to offset the disadvantages under which American ships operate, regardless of their ownership, is another matter. In this connection it is well to remember that the Canadian Pacific does not build its ships in Canada, nor does it operate them on an American wage scale. In this respect they are no different from any other fleet of British ships. The offhand statements which have recently appeared, that all that is needed to make American overseas vessels paying propositions is their operation by American rail lines, may, if taken alone, do more harm than good, but if considered in conjunction with the general effect upon over-

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seas trade of the active participation in it of some of our wealthiest and most powerful corporations the situation appears in a different light.

While this country has at various times set forth its desire and intention to carry at least 50 percent of its foreign commerce in its own vessels, the impression prevails, particularly in foreign quarters, that this is but a gesture and our failure so far to make good our claims by the construction of modern and efficient vessels gives support and strength to this opinion. In view of the active opposition to continued government operation of ships its continuance is, at best, a matter of doubt and uncertainty. So long as this state of things continues, no real progress can be made, but with the government definitely out and the railroads definitely in the shipping picture it would present a very different appearance.

The Steel Corporation is strong enough to ensure its American flag ships a fair share of overseas business and it is operating them successfully. It seems entirely possible that the great railroads could operate vessels which they owned under similar favorable conditions. Therefore we hope that steps will be taken at the approaching session of the Congress to make possible and to encourage the railway ownership of ocean steamship lines.

Power Transmission

IT is a rather curious fact that in the early propeller driven vessels and now in the most recent and advanced types of propelling machinery, the designers have been confronted by the same difficult situation—the wide difference in economic and practical speed of revolution between the driving machinery and the propeller. The *Great Britain,* the first seagoing screw vessel, had heavy, slow running engines, the necessary rate of propeller revolutions being obtained by interposing a sprocket chain gearing between the crank shaft and the propeller shaft. Other early vessels were fitted with tooth gearing of various types, the object in every case being to transmit power from a slow running engine to a relatively fast running propeller. So far as the writer is aware, the last use of mechanical gearing for this purpose, on large vessels, was in certain of the high speed cruisers built for our navy during the latter part of the Civil war. Long before these ships were designed, direct connected engines had come into common use, but in their case slow running engines and gears were adopted because of the fear that the long and rather lightly built wooden hulls could not withstand the vibrations produced by fast running machinery.

Direct connected propelling machinery was in practically universal use from a time shortly after the first screw propelled vessels appeared up to the early years of the present century and is still found wherever reciprocating steam engines or large oil engines supply the propelling power.

The advent of the marine steam turbine in 1897 at once opened up new problems; particularly in propeller design. The type of propeller used in conjunction with the reciprocating engine, even with high speed torpedo boat machinery, and the steam turbine were far apart as to economical revolutions. Direct drive was still adhered to but the greatest attention was given to improving and modifying propeller design to meet the new requirement of high tip speed. On the *Turbinia* and certain of the turbine driven vessels immediately following her, multiple screws were tried, two or three, of small diameter, being fitted on each shaft. Improvements in propeller designs soon made the fitting of more than one screw on each shaft unnecessary but although many successful turbine steamers were built the use of the turbine was confined practically entirely to high speed vessels with fast running propellers. Even in them it was evident that the turbine could not perform at its best, so far as economy of steam consumption was concerned, even when running at the highest rate permitted by the improved propeller wheels while for slow speed cargo ships its use, direct connected, was out of the question.

The first geared turbine vessel, the *Vespasian,* came out in 1910, and here may be said to have commenced, as a distinct and modern problem, marine power transmission as affected and modified by the type of engine or prime mover employed.

Basically the new problem is the same as that which confronted the designers of the early screw propelled vessels, some ninety years ago—the connecting up of an engine and propeller which run at widely different speeds, but while the early engineers had to increase revolutions in going from the engine to the propeller, today the reverse is the case and the decrease now demanded is, in many instances, vastly greater than was the increase in revolutions on the first large screw propelled ships.

In the majority of cases where the steam turbine furnishes the propulsive power, mechanical reduction gearing has been and still is employed. This type of gear has been highly developed and with the perfected machine tools and methods now used in its production operates with a minimum of wear, vibration or noise. It undoubtedly is the most efficient type of reduction gearing, as measured by the ratio of power generated by the engine to that delivered to the propeller shaft.

Two other types of reduction gearing are in use in connection with steam turbines although to a much more limited extent than the mechanical gear. The Föttinger hydraulic gear was experimented with in Germany some years ago, but at that time appeared to make little headway. Recently, as a cushioning and reversing mechanism in conjunction with geared Diesel engines its use is being revived—this development will be referred to later.

The electric transmission of propelling power has had, in this country, an extended development. The first large vessel to be so equipped, the naval collier *Jupiter* (now the aircraft carrier *Langley*) was launched in 1912 and since then, with the exception of destroyers, but few of our naval vessels have been fitted with mechanical gearing, while a considerable number, having an enormous total horsepower in their propelling machinery, have been equipped with turbo-electric drive—our navy has in fact been the leader in the adoption of this type of power transmission. For large naval vessels, which for the greater portion of the

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time use but a fraction of their total available power, electric reduction has manifest advantages but considerable transmission loss is unavoidable and the weight and space occupied by the battleship power plants are considerable as is also their cost. These latter considerations have hitherto acted to prevent the introduction of the turbo-electric drive on large merchant vessels but now it is being installed at Newport News in the largest merchant steamers so far built in this country. For a ship of the liner type it is somewhat difficult to see just why electric drive is adopted, as such vessels usually run for most of the time at or near their full power. To be sure, reversing turbines are dispensed with but this saving in first cost must be much more than offset by the cost of the electrical equipment. Furthermore the possibility of using a portion of the main propelling plant to operate auxiliaries, both at sea and in port as can very easily be done with a Diesel electric combination, does not exist with the steam-electric drive. However the two new I. M. M. ships are both to have turbo-electric propelling machinery and the engineers of that company profess to have entire confidence in the success of their venture. It is reported that their machinery is being supplied at a less cost than that which was asked for reversible turbines and mechanical reduction gears. If this low price can be maintained, in other words, if it is a "fair" price and not one which has been arbitrarily reduced in order to ensure the use of electrical machinery, the future of the turbo-electric drive is indeed bright. In any event the performance of the new vessels will be watched with the greatest interest by engineers and shipowners, the world over.

British shipbuilders have so far adhered closely to the mechanical reduction gear for both naval and merchant steam vessels. A cargo steamer, the *Wulsty Castle*, of about 3,500 gross tons, fitted with a turbo-electric propelling plant was built in 1918, but her performance has apparently not been entirely satisfactory as the steam electric machinery has now been replaced by a geared Diesel drive. So far as we know, no other British ship at present in service has a steam-electric drive, but early this year the P. and O. Company, one of the largest and best British shipping organizations, ordered a large liner the propelling machinery of which is to be of this type. The fact that a company of the high standing and well ordered conservation of the P. and O. feels itself justified in making such a radical departure from its usual policy is, to say the least, a matter of congratulation for the advocates of electrical reduction gear on shipboard. It looks as though the most hard headed and conservative marine engineers may eventually be forced to admit that there is "something in it" beside trouble and expense.

While the question of power transmission for steam machinery is pretty well developed and proceeding along well recognized lines, with the oil engine it seems to be hardly past the initial stage. So long as powers remain relatively small direct drive has been and still is the general rule but as time goes on it is becoming quite clear that there are two factors which are tending strongly towards departure from the hitherto orthodox arrangement, with only the simple shaft between the engine and propeller. The first of these factors is increasing power. The wide spread adoption of Diesel engines in ships of the liner class which is now taking place involves the production of great power, much in excess of that required for cargo ships to which until comparatively recently the use of the Diesel has practically been confined. Most of the motor liners so far built or projected have direct drive, the necessary power being obtained by fitting multiple shafts, by substituting double acting for single acting engines and by increasing the number and size of the cylinders. The largest and most powerful motor liner so far launched, the Italian *Augustus*, has four shafts, each driven by a double acting two cycle engine of 7,000 shaft horsepower having six cylinders about 27½ inches in diameter and 47½ inches stroke. So far as type of engine and number of shafts are concerned, the practicable limit of power is reached in this vessel, but the number of cylinders and their dimensions could undoubtedly be further increased. Following the present general type of cylinder design and using the materials now available it may be possible to develop as high as 2,000 horsepower per cylinder in a double acting two cycle engine. A four shaft arrangement of eight cylinder engines would thus deliver between 60,000 and 70,000 horsepower. It is rumored that even larger installations are being considered, but the weight, space occupied and cost of such enormous engines would appear to be prohibitive. For large powered motorships, many engineers are seeing a way out of the difficulty through the adoption of smaller, fast running engines and some form of reduction gear.

A second factor tending towards a breaking away from the direct connected drive is the attempt to reduce the cost of marine Diesel engines by manufacturing them on a mass production basis, a distinctly American development. Obviously Diesel engines of large power cannot be produced economically by manufacturing methods—the number required is far too small—so a combination of small engines with some efficient means of combining their power and transmitting it to the propeller is required if the motorship is to benefit by the economy resulting from mass production of her machinery. It seems evident that electric transmission will be essential for all but the smallest powered vessels, if multiple, standardized power units are to be employed.

As with steam turbines, mechanical, hydraulic and electrical transmission and reduction gearing are being used with oil engines. The Germans have been the pioneers in the use of mechanical gears, the first installations of this type being devised to utilize, in commercial work, high speed submarine engines. Some apprehension having been felt as to the effect of the sharply varying torque of Diesels upon rigid gears, long flexible sleeve couplings were introduced between the engines and gears in the original plants, which were installed on two cargo ships and on two large passenger ships, the *Monte Sarmiento* and *Monte Olivia*.* It was found, however, that this arrangement greatly increased vibration, instead of reducing its effect, the couplings being badly damaged by the synchronism which was set up by them. The sleeve couplings were then

*See *Marine Engineering and Shipping Age* for February, 1925.

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removed and the crank shafts rigidly connected to the gears, with the result that the machinery on all of the ships is reported to be giving entire satisfaction. Mechanical gearing has recently been ordered by the Hamburg American Company for the two large motorships *Milwaukee* and *Cincinnati,* which it has under construction for its New York-Hamburg line. These ships will each have four M.A.N. two cycle double acting engines of an aggregate shaft horsepower of 13,000, the largest geared Diesel installations so far attempted.

The combination of mechanical gears with hydraulic transmission has been developed by the Vulcan Works of Hamburg and has been installed in a number of large German cargo vessels. The hydraulic coupling or transmitter is so arranged that the propellers may be reversed and the ship maneuvered while the engines run constantly in one direction. Thus complicated and expensive air reversing gears on the engines are dispensed with, and, furthermore, the hydraulic coupling forms an effective cushion between engines and gears. So far as the writer knows, neither British nor American shipbuilders have installed hydraulic transmission in any vessels, but a mechanical gearing consisting of a combination of Falk reduction gears and Metten hydraulic clutches** has been developed in this country and is operating successfully on several small vessels. By means of this gear, both reduction and reversal are accomplished, the engines running constantly in one direction.

The Diesel electric type of propelling machinery has come into widespread use in this country, although it is apparently not looked upon with favor abroad. For all services where the propelling power varies widely and where power is used for other purposes than propelling the vessel alone it offers distinct advantages and has found favor in a wide range and variety of services. While up to the present time its use has been confined mainly to vessels of relatively small size, its performance on the tanker *J. W. Van Dyke* of the Atlantic Refining Company's fleet, a vessel of 4,900 gross tons and 2,300 horsepower, has been so entirely satisfactory that this company is converting three tankers similar to the *Van Dyke* to Diesel electric drive and has ordered abroad two new tankers of 12,500 tons deadweight and 2,800 shaft horsepower with the same type of propelling machinery. These new vessels will be built in Great Britain and are the largest Diesel electric ships which have yet been ordered.

As before remarked, the Diesel electric combination has made little progress abroad, the only British vessels of importance in which it is installed being the three fruiters built by Cammell-Laird in 1924. The machinery of these vessels as originally installed proved unsatisfactory and extensive alterations have been carried out, but it is understood that the difficulties experienced related to the engines themselves and not to the electrical transmission machinery.

This somewhat long drawn out record of facts and tendencies covers, in a general way, the problem of the transmission and conversion of power on board ship as it stands today. The difficulties facing the engineer in his attempt to efficiently convert engine power into propulsive effort in modern high powered vessels are sufficiently well indicated; particularly it is made clear that in the future application of the Diesel to ship propulsion, especially in those cases where great power is required, the effective transmission of this power from engines to propeller will be a vital matter and assume an importance nearly if not quite equal to the design of the engines themselves.

** See *Marine Engineering and Shipping Age* for August, 1926.

Ship Conversion

WHATEVER one may think regarding the advisability of further machinery conversion of Shipping Board vessels the decision to install Diesel engines in certain additional ships must at least appear as an act of justice to the builders of this type of machinery. As has been before pointed out in these columns, the engine builders who furnished the machinery for the first lot of conversions did so at a very considerable monetary loss, a loss which they doubtless considered warranted as necessary to bring their products into more extended practical use in this country and further justified by the expectation of repeat orders. It is gratifying to know that they are being given the opportunity of securing further work for the board—it is to be hoped at more remunerative figures.

The basic idea of the conversion program is the securing of greater operative economy in the board's vessels. This being so, it seems entirely in order that some attention and assistance should be given to the methods which are now being rapidly developed to increase the economy of marine steam machinery, a development which is actively engaging the interest of shipowners and marine engineers, both here and abroad.

Without in the least wishing to detract from the success of the Diesel machinery which has so far been installed in the board's vessels or to disparage the policy of installing more of this type of engine, it seems to us that the board would be entirely justified and is indeed under a certain amount of obligation to devote some portion of the funds which it has available for conversion purposes to the installation of the most modern steam machinery in some of its ships, at least two, in order that it may obtain first hand information as to the relative merits of oil engines and high pressure steam plants for the propelling of cargo vessels.

A step in this direction has already been made in the decision to equip the *Mercer* with pulverized fuel apparatus. A further and logical step would be the installation of a high pressure high superheat steam plant, in conjunction with boilers equipped for the burning of pulverized coal. If one may judge by the performance of the *King George V* and the *Empress of Australia,* to say nothing of the economies resulting from the use of high pressure steam and superheat in shore power stations, it is entirely reasonable to expect that the combination of pulverized fuel with the modern boiler and turbine plant might result in an overall performance in advance of anything yet realized on shipboard.

(*Continued on page* 564)

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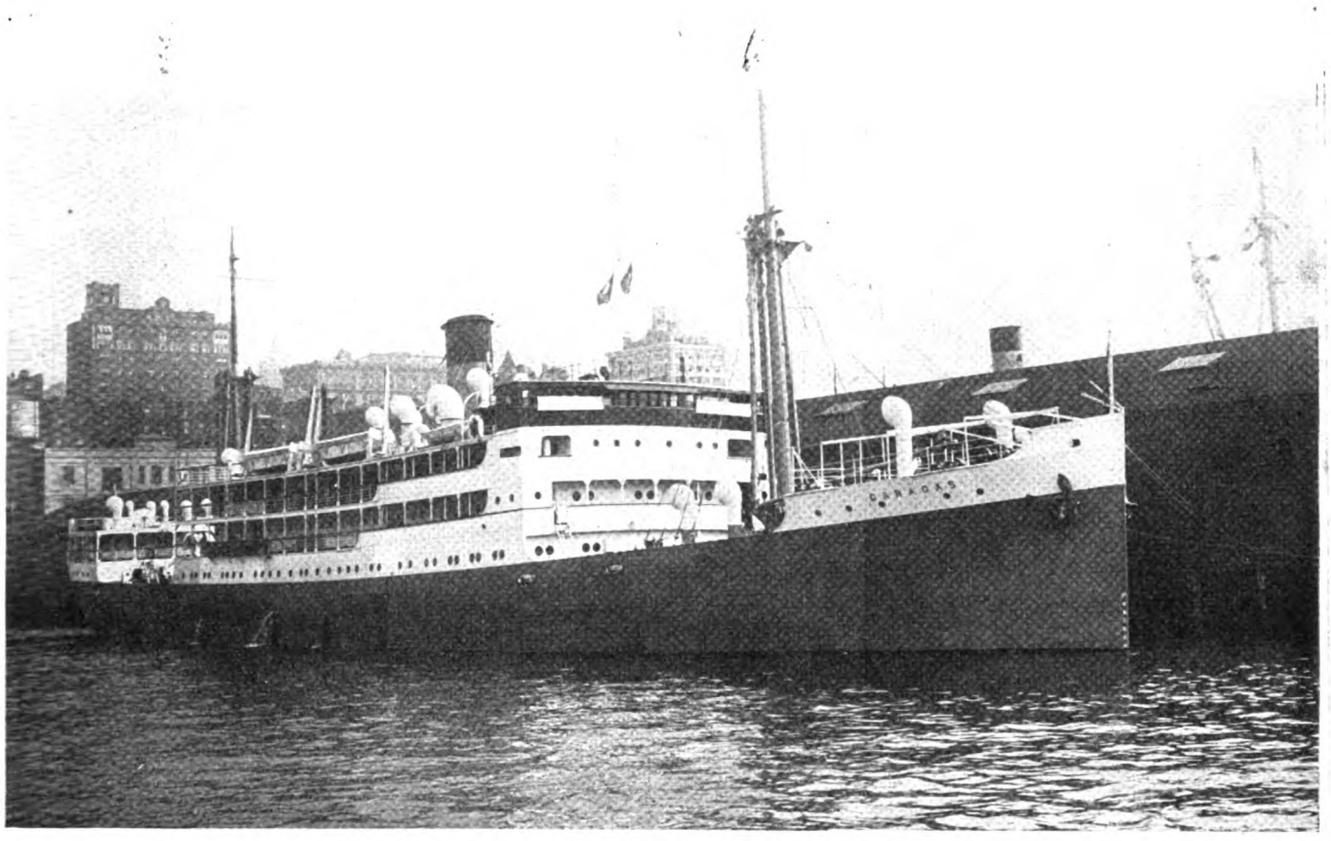


New Red D steamship Caracas at her pier in New York harbor

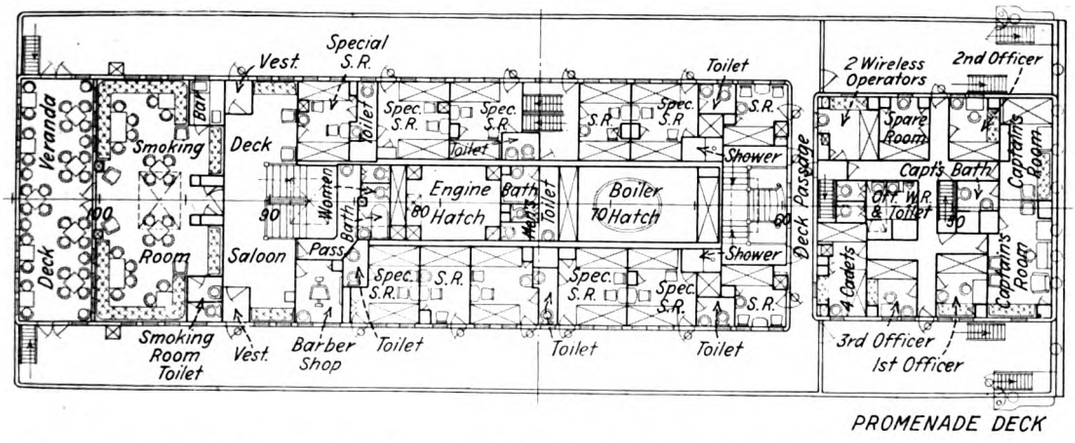
The New Red D Line Steamship Caracas

Designed by Theodore E. Ferris and built by the Newport News Shipbuilding and Dry Dock Company for the Atlantic and Caribbean Steam Navigation Company

THE opportunity of inspecting a new American ship has come all too seldom these past few years and it was therefore particularly pleasant when such an occasion did occur last month to find as the object of one's attention such an outstanding example of the applied science of naval architecture and the art of shipbuilding as is presented by the new *Caracas* of the Red D line.

The *Caracas* is, relatively speaking, a ship of moderate size, but the exacting requirements imposed by the unusual conditions under which she operates make her a vessel of much more than ordinary interest to the naval architect and to the shipowner and operator, as well.

How very well Mr. Theodore E. Ferris, the New York naval architect and marine engineer who designed the vessel, has solved the problem presented to him by the Atlantic and Caribbean Steam Navigation Company can only be realized by a careful study of his plans and specifications but the following outline description will serve to convey



Plan showing arrangement of accommodations on the promenade deck

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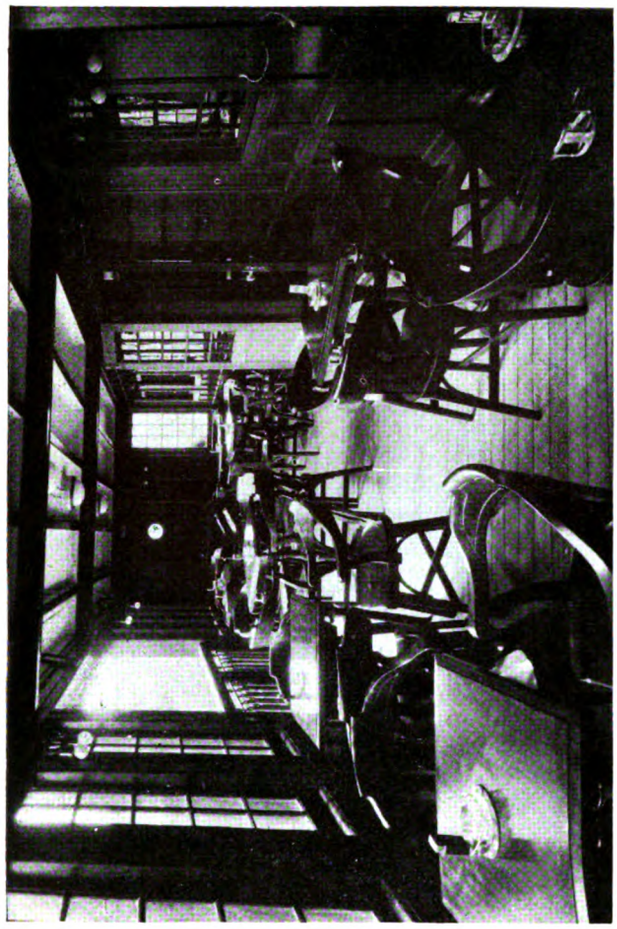
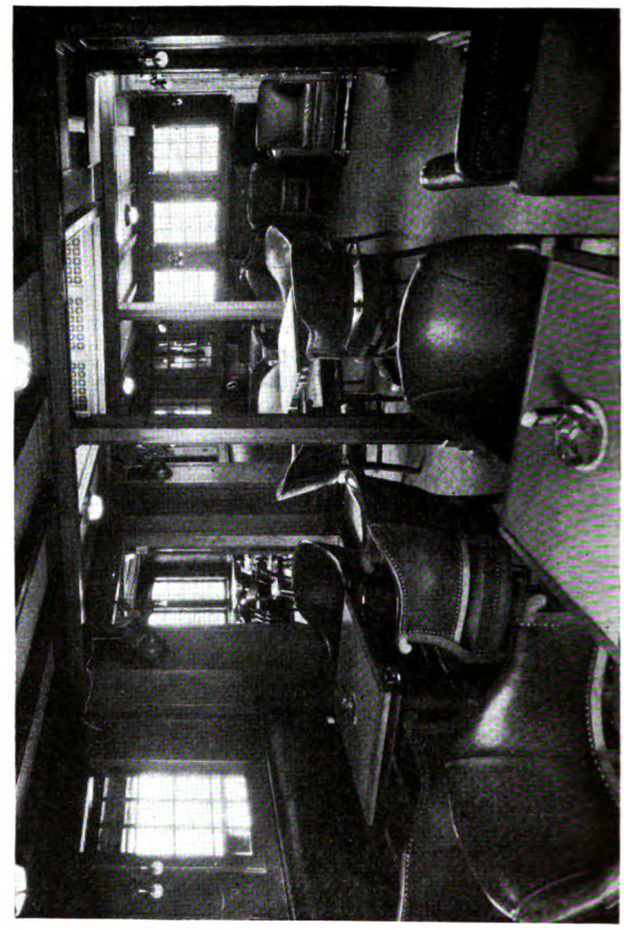


Veranda cafe



Smoking room

Dining room

Lounge

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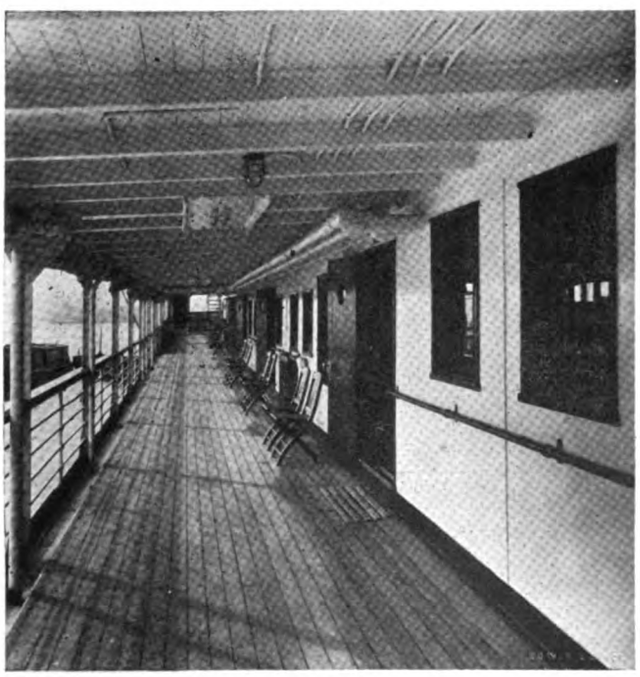
to the reader an idea of the difficulties to be met and the thoroughly practical and satisfactory manner in which they have been overcome. Needless to say, the Newport News Shipbuilding and Dry Dock Company, the builders of the vessel, have carried out the designer's and owners' plans and ideas to the last detail; an inspection of the ship reveals excellent workmanship in every department and one steps ashore with the conviction that this latest addition to the long list of vessels turned out at the Virginia shipyard to Mr. Ferris' designs is a credit to all concerned.

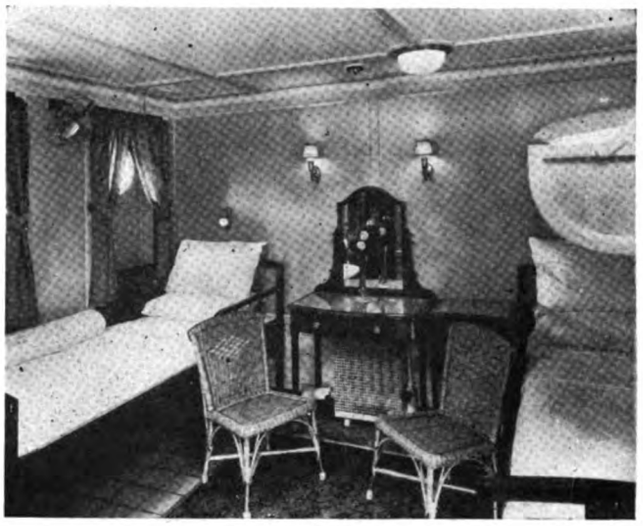
The Atlantic and Caribbean Steam Navigation Company, or, as it is more generally known, the Red D Line, is one of the very few American steamship companies which have maintained a foreign passenger and cargo service continuously over a long period of years. Starting from New York, its vessels deliver cargo at Porto Rico and other West Indian points, finally arriving at Maracaibo, Venezuela, the southern terminus of the line. Here a bar at the harbor entrance strictly limits the draft of water and the harbor facilities are such as also to limit the ship's length. As passengers are carried, fairly good speed is essential and it goes without saying that the greatest possible deadweight capacity, both when leaving New York for the voyage south and on entering and leaving Maracaibo, is a vital requirement.

To meet these various conditions the builders were required to guarantee the equipped weight of the vessel, the speed under sea service conditions at a specified draft, the shaft horsepower and revolutions under certain specified conditions, and the fuel consumption per shaft horsepower; the last to be determined after the vessel had entered service. The successful solution of these various problems is embodied in the new vessel which has the following general dimensions and particulars:

Length overall (18-foot waterline)	335 feet 6 inches
Length between perpendiculars	323 feet 0 inches
Beam, molded	51 feet 0 inches
Depth, molded (upper deck)	22 feet 0 inches
Deep load draft	18 feet 0 inches
Displacement at 18-foot draft	6,460 tons
Block coefficient at 18-foot draft	0.734
Displacement at 16-foot draft	5,640 tons
Block coefficient at 16-foot draft	0.720
Deadweight capacity at 18-foot draft	3,560 tons



Promenade deck



First class stateroom

Deadweight capacity over Maracaibo Bar at 11-foot 4-inch mean draft	910 tons
Cargo capacity (under beams and inside of battens)	159,900 cubic feet
Fuel oil capacity, total	704 tons
Passenger capacity	
1st class, maximum in 40 rooms	113
2nd class, maximum in 9 rooms	24
Crew	77
Gross tonnage	3,366
Net tonnage	1,961
Service sea speed at 16-foot mean draft	13 knots
Designed shaft horsepower	3,500

The *Caracas* is a twin screw vessel of the two deck type with long bridge, forecastle and poop erections, straight stem and cruiser stern. The main, upper and bridge decks are completely plated and a double bottom is fitted, extending from the forepeak to the afterpeak bulkhead. There are seven watertight or oiltight bulkheads extending to the upper deck and four main cargo holds, access to the latter being had through four main cargo hatches on the upper deck and two cargo ports on each side of the vessel between the main and upper decks. The weather deck cargo hatches are provided with hinged steel covers. Fuel oil is carried in the double bottom and in deep tanks on each side of the ship in way of the boilers. These tanks extend to the upper deck and have cofferdam spaces arranged above them. Steel houses are erected on the poop and bridge decks, the top of the latter forming the promenade deck. The bridge deck house contains four fine first class suites at the after end, ordinary staterooms and special rooms with connecting toilets along the sides and a lounge and music room at the forward end. On the promenade deck amidships is a wooden house containing a deck saloon, smoking room, deck veranda and passengers' staterooms with connecting toilets, the top forming a passengers' sun deck and boat deck. Forward on the promenade deck a wooden house contains the captain's and officers' quarters with a chart room and wheel house, wireless room and navigating bridge above. The poop and poop deck house contain second class accommodations and waiters' quarters.

PASSENGER ACCOMMODATIONS

The first class dining saloon is located at the forward end of the bridge enclosure and is tastefully finished with a mahogany wainscoting and mahogany pilasters with cream colored painted paneling above. Aft of the dining saloon, on the upper deck, are the pantry and galley and, on the starboard passage, first class staterooms with engineers', purser's and doctor's rooms, etc., at the after end. Open-

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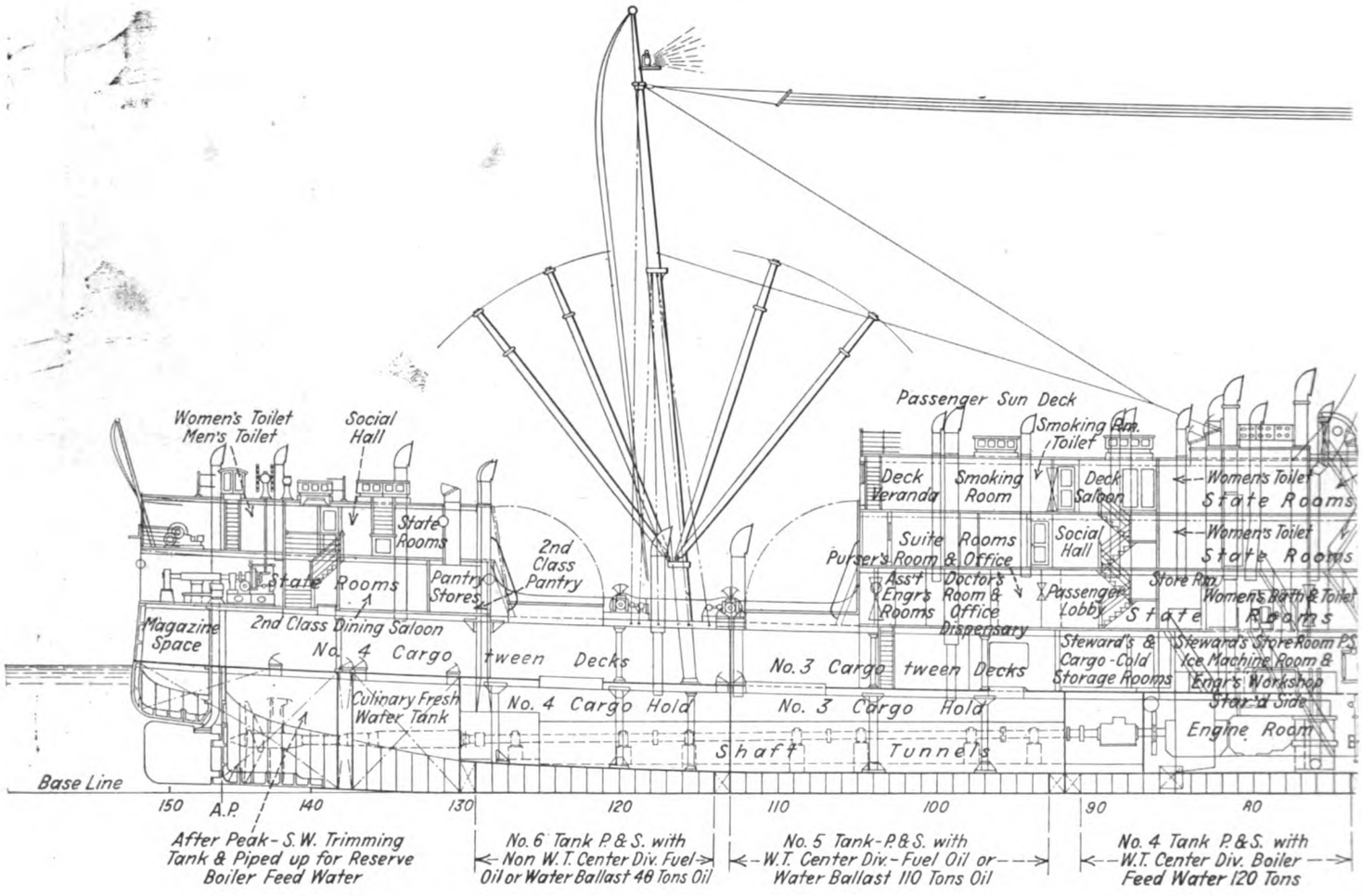

Inboard profile and plans of the poop, bridge, forecastle

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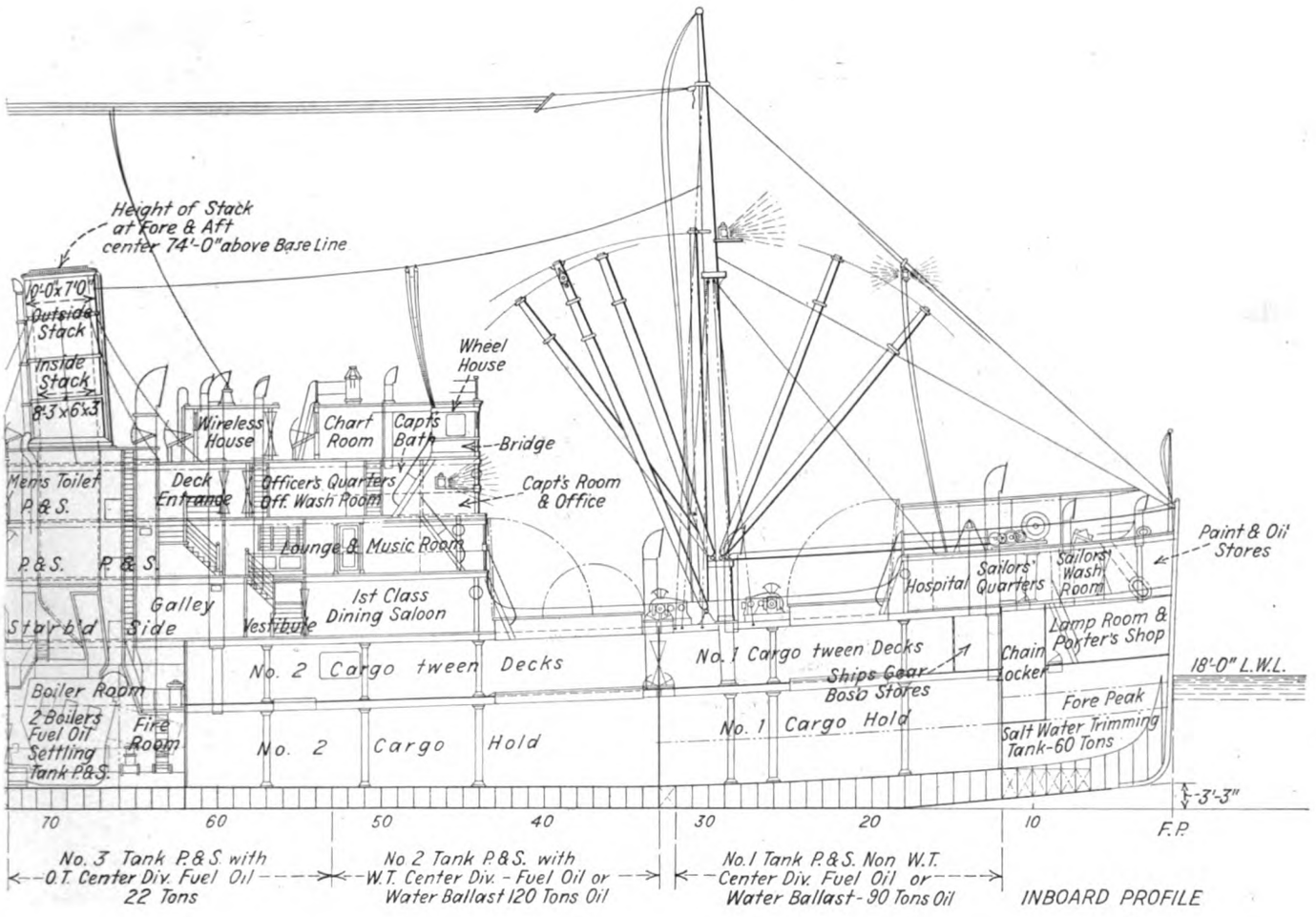
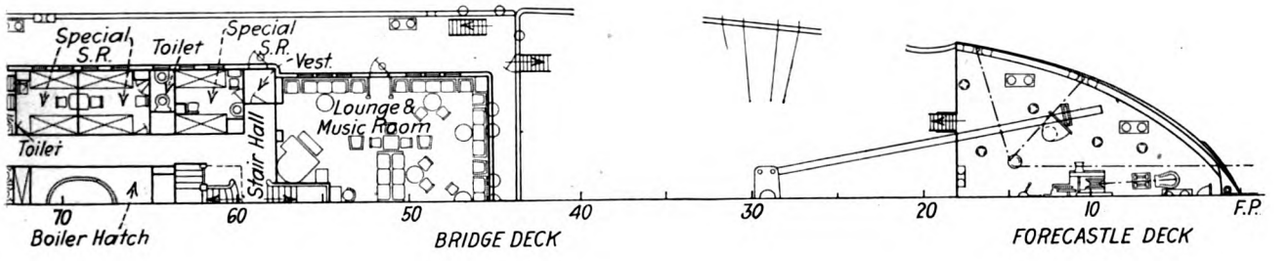
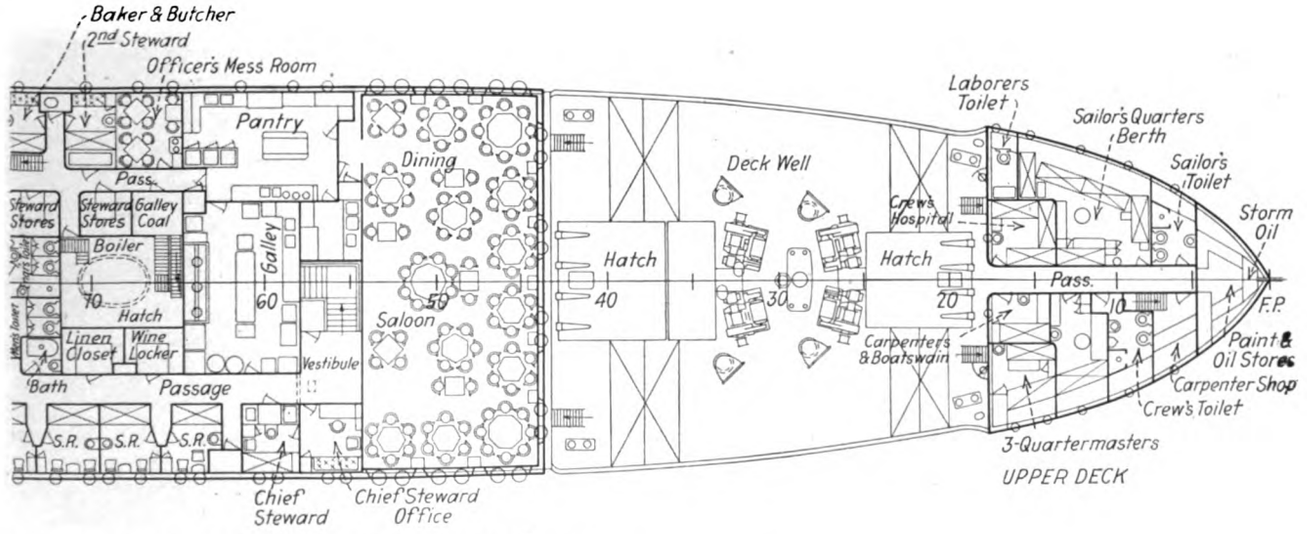

Height of Stack at Fore & Aft center 74'-0" above Base Line
10'-0" x 7'-0" Outside Stack
Inside Stack
8'-3" x 6'-3"
Wireless House
Chart Room
Capts Bath
Wheel House
Bridge
Capt's Room & Office
Officers Quarters Off. Wash Room
Deck Entrance
Mens Toilet P & S.
Lounge & Music Room
P & S.
P & S.
Galley
Stair b'd Side
Vestibule
1st Class Dining Saloon
No. 2 Cargo tween Decks
Boiler Room
2 Boilers Fuel Oil Settling Tank P & S.
Fire Room
No. 2 Cargo Hold
No. 1 Cargo tween Decks
Ships Gear Bosn Stores
No. 1 Cargo Hold
Hospital
Sailors' Quarters
Sailors' Wash Room
Paint & Oil Stores
Lamp Room & Poxter's Shop
Chain Locker
Fore Peak
Salt Water Trimming Tank-60 Tons
18'-0" L.W.L.
3'-3"
70 60 50 40 30 20 10 F.P.
No. 3 Tank P & S. with O.T. Center Div. Fuel Oil 22 Tons
No 2 Tank P & S. with W.T. Center Div. - Fuel Oil or Water Ballast 120 Tons Oil
No. 1 Tank P & S. Non W.T. Center Div. Fuel Oil or Water Ballast - 90 Tons Oil
INBOARD PROFILE





and upper decks of the new Red D steamship Caracas

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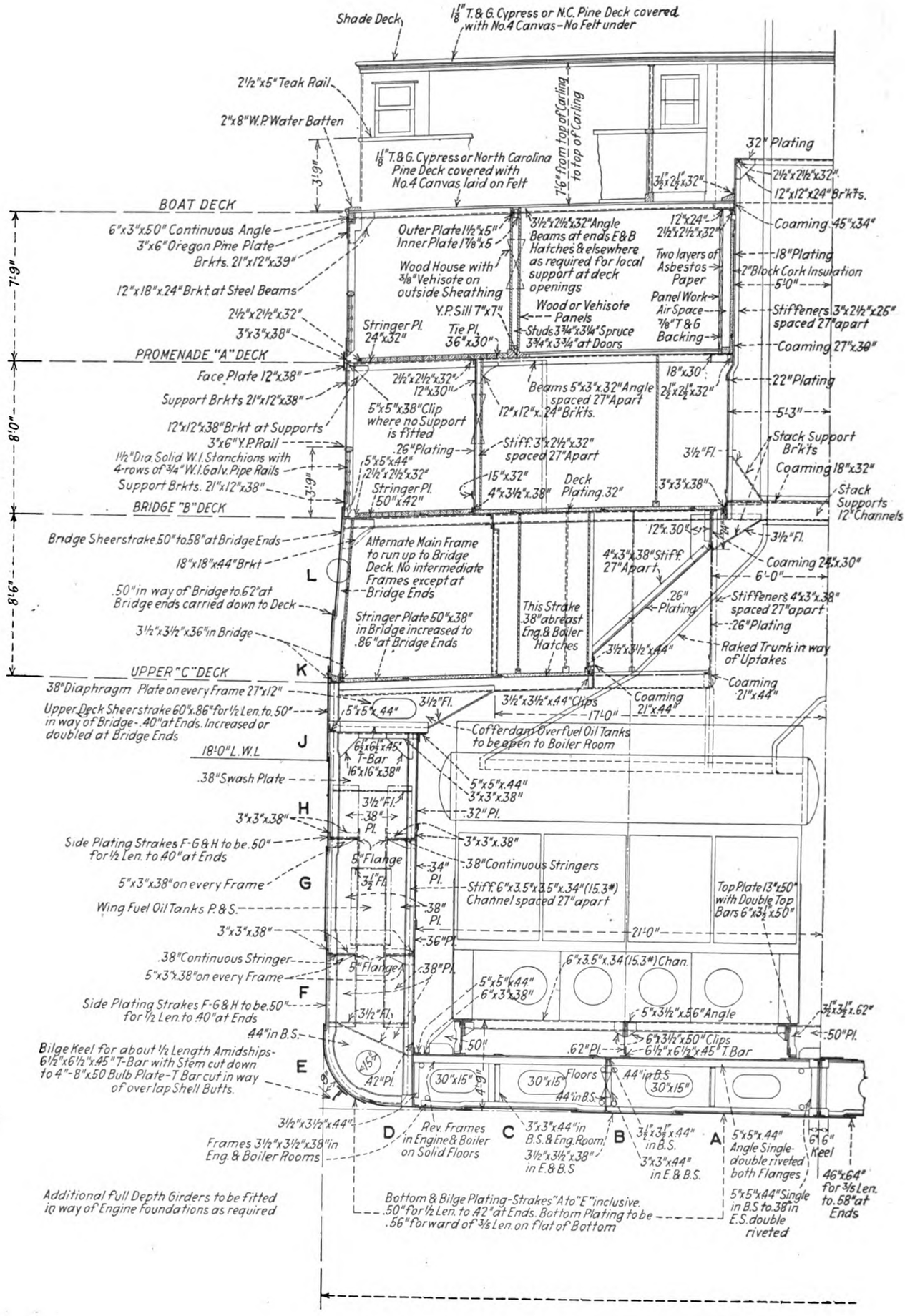
Shade Deck
1 1/8" T. & G. Cypress or N.C. Pine Deck covered with No.4 Canvas - No Felt under
2½"x5" Teak Rail
2"x8" W.P. Water Batten
1 1/8" T. & G. Cypress or North Carolina Pine Deck covered with No.4 Canvas laid on Felt
7'6" from top of Carling to top of Carling
3'9"
BOAT DECK
7'9"
6"x3"x.50" Continuous Angle
3"x6" Oregon Pine Plate
Brkts. 21"x12"x.39"
12"x18"x.24" Brkt. at Steel Beams
2½"x2½"x.32"
3"x3"x.38"
Stringer Pl. 24"x.32"
Tie Pl. 36"x.30"
Outer Plate 1½"x5"
Inner Plate 1 7/8"x5
Wood House with 3/8" Vehisote on outside Sheathing
Y.P. Sill 7"x7"
3½"x2½"x.32" Angle Beams at ends E & B Hatches & elsewhere as required for local support at deck openings
Wood or Vehisote Panels
Studs 3¾"x3¼" Spruce 3¾"x3¾" at Doors
12"x24" 2½"x2½"x.32"
Two layers of Asbestos Paper
Panel Work
Air Space
⅞" T & G Backing
3½"x2½"x.32"
2½"x2½"x.32"
12"x12"x24" Brkts.
Coaming .45"x34"
18" Plating
2" Block Cork Insulation
5'0"
Stiffeners 3"x2½"x.25" spaced 27" apart
Coaming 27"x.30"
PROMENADE "A" DECK
8'0"
Face Plate 12"x.38"
Support Brkts 21"x12"x.38"
12"x12"x.38" Brkt at Supports
3"x6" Y.P. Rail
1½" Dia. Solid W.I. Stanchions with 4-rows of ¾" W.I. Galv. Pipe Rails
Support Brkts. 21"x12"x.38"
3'9"
2½"x2½"x.32"
12"x.30"
5"x5"x.38" Clip where no Support is fitted
.26" Plating
5"x5"x.44"
2½"x2½"x.32"
Stringer Pl. 1.50"x.42"
Beams 5"x3"x.32" Angle spaced 27" Apart
12"x12"x.24" Brkts.
Stiff. 3"x2½"x.32" spaced 27" Apart
15"x.32"
4"x3½"x.38"
Deck Plating .32"
18"x.30"
2½"x2½"x.32"
22" Plating
5'3"
Stack Support Brkts
3½" Fl.
Coaming 18"x.32"
3"x3"x.38"
Stack Supports 12" Channels
BRIDGE "B" DECK
8'6"
Bridge Sheerstrake .50" to .58" at Bridge Ends
18"x18"x.44" Brkt
L
.50" in way of Bridge to .62" at Bridge ends carried down to Deck
3½"x3½"x.36" in Bridge
Alternate Main Frame to run up to Bridge Deck. No intermediate Frames except at Bridge Ends
Stringer Plate 50"x.38" in Bridge increased to .86" at Bridge Ends
This Strake .38" abreast Eng. & Boiler Hatches
12"x.30"
4"x3"x.38" Stiff. 27" Apart
.26" Plating
3½"x3½"x.44"
3½" Fl.
Coaming 24"x.30"
6'-0"
Stiffeners 4"x3"x.38" spaced 27" apart
.26" Plating
Raked Trunk in way of Uptakes
Coaming 21"x.44"
UPPER "C" DECK
K
38" Diaphragm Plate on every Frame 27"x12"
Upper Deck Sheerstrake 60"x.86" for ½ Len. to .50" in way of Bridge - .40" at Ends. Increased or doubled at Bridge Ends
5"x5"x.44"
3½" Fl.
3½"x3½"x.44" Clips
17'-0"
Coaming 21"x.44"
Cofferdam Over Fuel Oil Tanks to be open to Boiler Room
J
18'0" L.W.L
6½"x6½"x.45" T-Bar 16"x16"x.38"
.38" Swash Plate
5"x5"x.44"
3"x3"x.38"
.32" Pl.
H
3½" Fl.
.38" Pl.
3"x3"x.38"
Side Plating Strakes F-G & H to be .50" for ½ Len. to .40" at Ends
5" Flange
.34" Pl.
3"x3"x.38"
.38" Continuous Stringers
5"x3"x.38" on every Frame
G
3½" Fl.
Stiff. 6"x3.5"x.5"x.34" (15.3#) Channel spaced 27" apart
Top Plate 13"x.50" with Double Top Bars 6"x3½"x.50"
Wing Fuel Oil Tanks P. & S.
.38" Pl.
3"x3"x.38"
.36" Pl.
21'0"
.38" Continuous Stringer
5"x3"x.38" on every Frame
5" Flange
.38" Pl.
6"x3.5"x.34 (15.3#) Chan.
5"x5"x.44"
6"x3"x.38"
F
Side Plating Strakes F-G & H to be .50" for ½ Len. to .40" at Ends
3½" Fl.
5"x3½"x.56" Angle
3½"x3½"x.62"
.44" in B.S.
.50" Pl.
6"x3½"x.50" Clips
.50"
.62" Pl.
6½"x6½"x.45" T. Bar
Bilge Keel for about ½ Length Amidships - 6½"x6½"x.45" T-Bar with Stem cut down to 4"-8"x.50 Bulb Plate - T Bar cut in way of overlap Shell Butts.
E
A15A
.42" Pl.
30"x15"
Floors
44" in B.S.
3½"x3½"x.44"
Frames 3½"x3½"x.38" in Eng. & Boiler Rooms
D
Rev. Frames in Engine & Boiler on Solid Floors
C
3"x3"x.44" in B.S. & Eng. Room
3½"x3½"x.38" in E. & B.S.
B
3½"x3½"x.44" in B.S.
3"x3"x.44" in E. & B.S.
A
5"x5"x.44" Angle Single-double riveted both Flanges
5"x5"x.44" Single in B.S. to .38" in E.S. double riveted
6'6" Keel
46"x64" for ⅗ Len. to .58" at Ends
Additional full Depth Girders to be fitted in way of Engine Foundations as required
Bottom & Bilge Plating - Strakes "A to E" inclusive. .50" for ½ Len. to .42" at Ends. Bottom Plating to be .56" forward of ⅗ Len. on flat of Bottom

Section through boiler room

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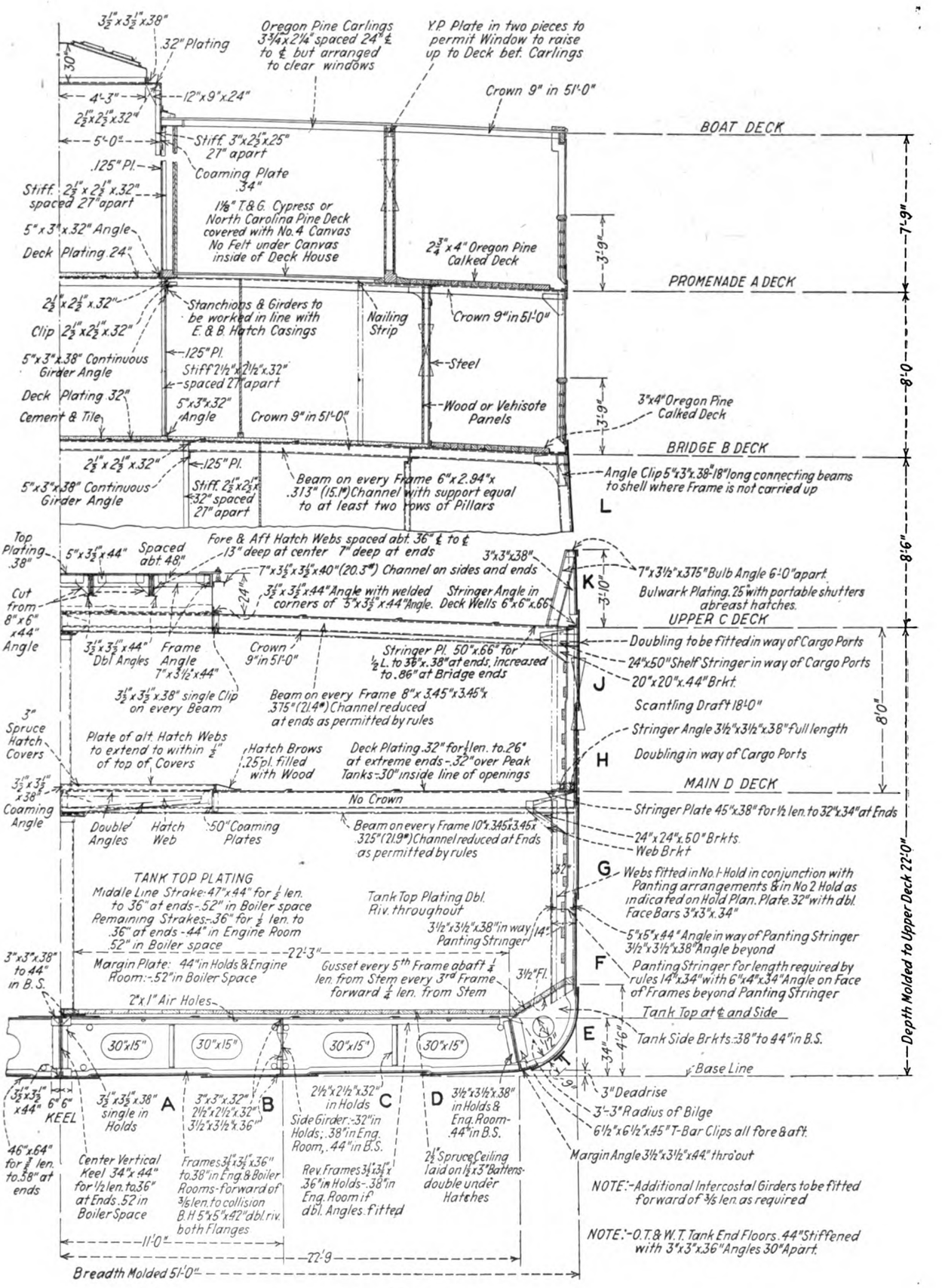
BOAT DECK
PROMENADE A DECK
BRIDGE B DECK
UPPER C DECK
MAIN D DECK
Tank Top at ℄ and Side
Base Line
Oregon Pine Carlings 3¾"x2¼" spaced 24" ℄ to ℄ but arranged to clear windows
Y.P. Plate in two pieces to permit Window to raise up to Deck bet. Carlings
Crown 9" in 51'-0"
Coaming Plate .34"
1⅛" T.&G. Cypress or North Carolina Pine Deck covered with No. 4 Canvas No Felt under Canvas inside of Deck House
2¾"x4" Oregon Pine Calked Deck
Stanchions & Girders to be worked in line with E. & B. Hatch Casings
Nailing Strip
Steel
Wood or Vehisote Panels
3"x4" Oregon Pine Calked Deck
Beam on every Frame 6"x2.94"x .313" (15.1#) Channel with support equal to at least two rows of Pillars
Angle Clip 5"x3"x.38"-18" long connecting beams to shell where Frame is not carried up
Fore & Aft Hatch Webs spaced abt. 36" ℄ to ℄ 13" deep at center 7" deep at ends
7"x3½"x3½"x40" (20.3#) Channel on sides and ends
3½"x3½"x.44" Angle with welded corners of 5"x3½"x.44" Angle.
Stringer Angle in Deck Wells 6"x6"x.66"
7"x3½"x.375" Bulb Angle 6'-0" apart.
Bulwark Plating .25" with portable shutters abreast hatches.
Doubling to be fitted in way of Cargo Ports
24"x.50" Shelf Stringer in way of Cargo Ports
20"x20"x.44" Brkt.
Scantling Draft 18'-0"
Stringer Angle 3½"x3½"x.38" full length
Doubling in way of Cargo Ports
Stringer Pl. 50"x.66" for ½ L. to 36"x.38" at ends, increased to .86" at Bridge ends
Beam on every Frame 8"x3.45"x3.45"x .375" (21.4#) Channel reduced at ends as permitted by rules
Plate of alt. Hatch Webs to extend to within 2" of top of Covers
Hatch Brows .25" pl. filled with Wood
Deck Plating .32" for ¼ len. to .26" at extreme ends -.32" over Peak Tanks -.30" inside line of openings
No Crown
Stringer Plate 45"x.38" for ½ len. to 32"x.34" at Ends
Beam on every Frame 10"x3.45"x3.45"x .325" (21.9#) Channel reduced at Ends as permitted by rules
24"x24"x.50" Brkts.
Web Brkt
Webs fitted in No. 1 Hold in conjunction with Panting arrangements & in No. 2 Hold as indicated on Hold Plan. Plate .32" with dbl. Face Bars 3"x3"x.34"
5"x5"x.44" Angle in way of Panting Stringer 3½"x3½"x.38" Angle beyond
Panting Stringer for length required by rules 14"x.34" with 6"x4"x.34" Angle on Face of Frames beyond Panting Stringer
Tank Side Brkts. .38" to .44" in B.S.
TANK TOP PLATING
Middle Line Strake: 47"x44" for ¼ len. to 36" at ends -.52" in Boiler space
Remaining Strakes: -.36" for ¼ len. to .36" at ends -.44" in Engine Room .52" in Boiler space
Tank Top Plating Dbl. Riv. throughout
3½"x3½"x.38" in way Panting Stringer
Margin Plate: 44" in Holds & Engine Room: -.52" in Boiler Space
Gusset every 5th Frame abaft ¼ len. from Stem every 3rd Frame forward ¼ len. from Stem
2"x1" Air Holes
30"x15"
Margin Angle 3½"x3½"x.44" thro'out
3" Deadrise
3'-3" Radius of Bilge
6½"x6½"x.45" T-Bar Clips all fore & aft.
NOTE:-Additional Intercostal Girders to be fitted forward of ⅗ len. as required
NOTE:-O.T. & W.T. Tank End Floors .44" Stiffened with 3"x3"x.36" Angles 30" Apart.
Center Vertical Keel 34"x.44" for ½ len. to 36" at Ends .52 in Boiler Space
Frames 3½"x3½"x.36" to .38" in Eng. & Boiler Rooms - Forward of ⅗ len. to collision B.H. 5"x5"x.42" dbl. riv. both Flanges
Rev. Frames 3½"x3½"x .36" in Holds -.38" in Eng. Room if dbl. Angles fitted
2½" Spruce Ceiling laid on 1½"x3" Battens double under Hatches
11'-0"
22'-9"
Breadth Molded 51'-0"
Depth Molded to Upper Deck 22'-0"
7'-9"
8'-0"
8'-6"
8'0"
3'-10"
3'-9"
3'-9"
3'-10"
4'-6"
.34"
.37"
.14"
3½" Fl.
A
B
C
D
E
F
G
H
J
K
L

Midship section

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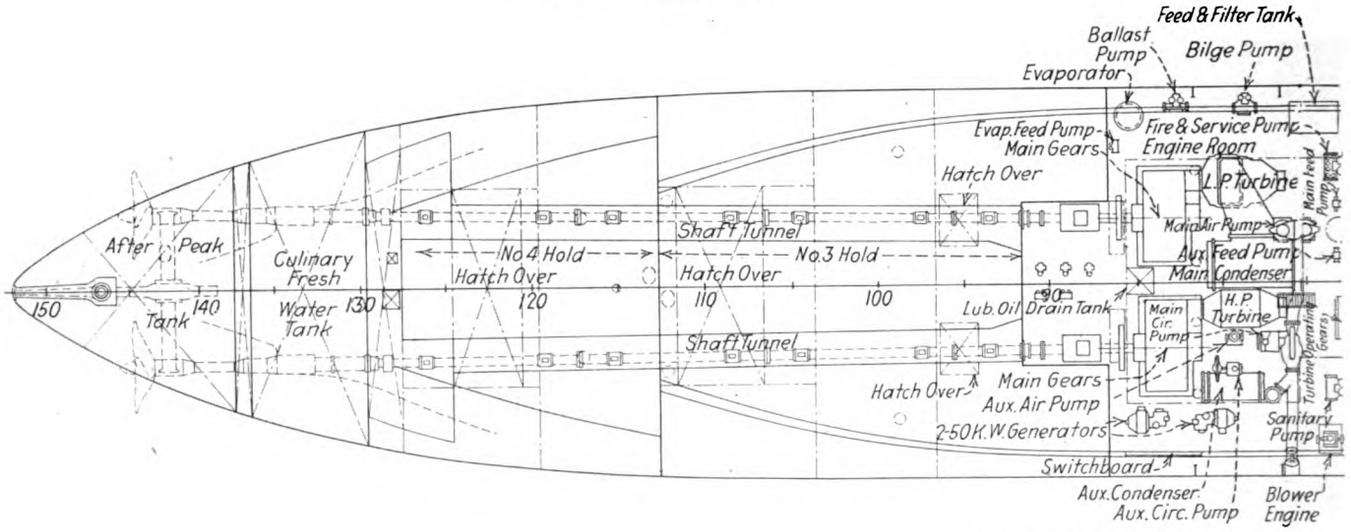

Lower hold plan of the Caracas

ing off the port side passage are firemen's, oilers', watertenders', cooks' and messmen's quarters and the usual messrooms, washrooms and storerooms.

The general effect of the woodwork, hangings and upholstery in the various public rooms, passages and lobbies is very pleasing and satisfying. There is some most excellent mahogany paneling and finish in the dining saloon and lounge and the smoking room and veranda, tea room, the former finished in oak and the latter in teak are particularly good examples of joiners' and decorators' work which have been very well done without at the same time being overdone.

The first class staterooms are most completely and tastefully furnished. Metal beds are installed in both special and regular rooms with, in certain rooms, a folding Pullman berth fitted above one of the beds. The wash basins are supplied with running cold water in all staterooms and toilets and with hot water in all special staterooms, in private and public toilets and in officers' staterooms and toilets. As will be seen from the plans numerous tub baths and showers are provided, the former when devoted to passengers' use being supplied with salt water in addition to the usual hot and cold fresh water.

The deck equipment is modern and complete in every respect and includes one 26-foot motor lifeboat and four 26-foot ordinary lifeboats all stowed under Steward mechanical davits and a 16-foot wooden working boat.

Deck Machinery and Hull Equipment

The deck machinery comprises an 8-inch by 10-inch Hyde spur geared steam windlass, for handling 2-inch stud chain cable, a 6¼-inch by 8-inch double cylinder warping winch, an American Engineering Company's screw type steam steering gear with 9-inch by 9-inch engine, controlled by telemotor and 8 Lidgerwood electric cargo winches, fitted with Westinghouse motors.

Other hull equipment includes a Cory automatic fire detecting system in the passenger and crew spaces, a Rich smoke detecting system for cargo holds and storerooms and a Foamite fire extinguishing system in the engine and boiler rooms. Pneumercator gages are fitted to all fuel oil tanks.

In addition to the ordinary cowl ventilators, mechanical ventilating is arranged for the engine room, ice machine room, engineers' work shop and stores, stewards' storeroom and main galley and pantry, Sturtevant electrically driven fans being used. Small electric fans are liberally distributed throughout the passengers' and crew's quarters, public rooms and lobbies. The ship is heated throughout by steam.

Stewards' and cargo cold storage rooms, located as shown upon the plans, have capacities of 2,000 and 1,500 cubic feet respectively. Refrigeration is supplied by two 6-ton ammonia compressors of the Brunswick-Kroeschell type.

The electric plant consists of two 50 kilowatt Westinghouse turbo generators supplying current at 110 volts in addition to which a Matthews 5-kilowatt gasoline driven emergency set is installed in the wireless house. The total number of electric lights, for all purposes, is approximately equivalent to 850 twenty-five watt lamps. The wireless outfit was furnished by the Radio Corporation of America.

Propelling Machinery

The propelling machinery consists of a Newport News cross compound impulse turbine set, the high pressure turbine driving the starboard propeller and the low pressure the port propeller through single reduction gears. Reverse turbines are arranged at the exhaust ends of both port and starboard main turbines. The turbines are designed to develop a total of 3,500 shaft horsepower at 1,800 revolutions per minute, the corresponding propeller revolutions being 125. The main condenser is cylindrical in form and has a cooling surface of approximately 5,300 square feet. Kingsbury thrust bearings are fitted to the propeller shafts, the latter being supported at their after ends by cast steel two-armed struts. The propellers are solid wheels of manganese bronze, 11 feet 10 inches in diameter.

Steam at 275 pounds pressure per square inch and 100 degrees superheat is supplied by two oil burning Babcock & Wilcox boilers having a combined heating surface of about 10,500 square feet and a superheating surface of 1,575 square feet. Forced draft is furnished by a Sturtevant steam driven fan located at the forward end of the engine room, the air being led by metal ducts to heating chambers on the boilers and thence to the oil burner fronts. The Babcock & Wilcox oil burning system is installed.

Auxiliaries

The following auxiliaries are located in the machinery spaces:

1 Newport News main circulating centrifugal pump for steam engine, 18 inches.

1 Worthington main air twin beam pump, 12 inches by 25 inches by 18 inches.

2 Worthington boiler feed vertical simplex pumps, 12 inches by 8 inches by 24 inches.

1 Worthington ballast vertical duplex pump, 7½ inches by 10¼ inches by 10 inches.

1 Worthington sanitary vertical duplex pump, 10 inches by 12 inches by 12 inches.

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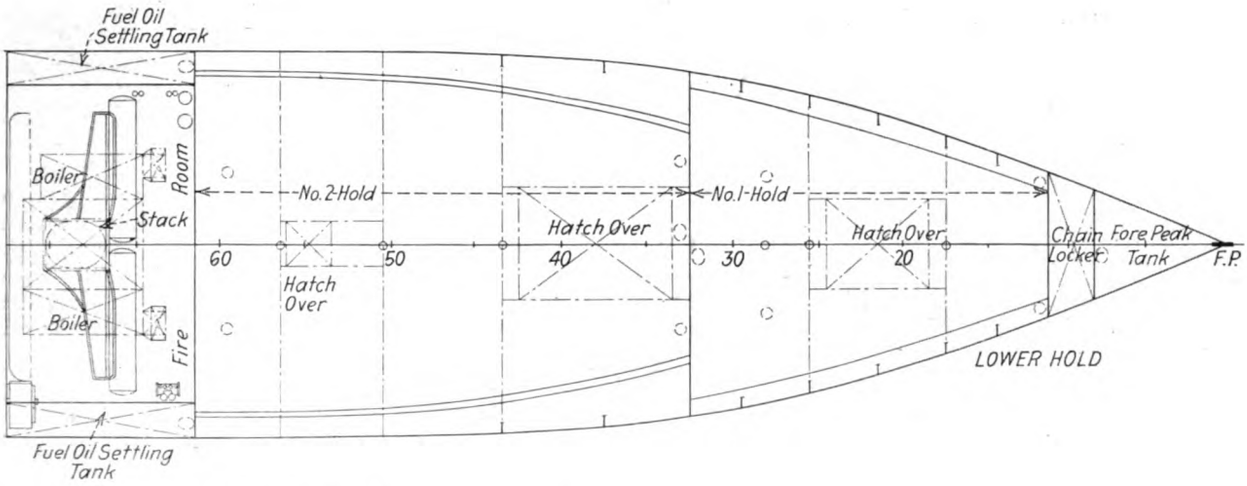


showing the machinery arrangement

2 Worthington fresh water vertical duplex pumps, 6 inches by 4 inches by 6 inches.

1 Worthington fire and general service vertical duplex pump, 12 inches by 8½ inches by 12 inches.

1 Worthington bilge vertical duplex pump, 7½ inches by 9 inches by 10 inches.

2 Worthington lubricating oil vertical simplex pumps, 8 inches by 10 inches by 12 inches.

1 Worthington auxiliary air vertical simplex pump, 7½ inches by 14 inches by 12 inches.

1 Newport News auxiliary circulating centrifugal pump, 8 inches; engine, 5 inches by 6 inches.

1 Worthington hot water circulating vertical duplex pump, 5¼ inches by 3½ inches by 5 inches.

1 Worthington ice machine circulating vertical duplex pump, 7½ inches by 7½ inches by 6 inches.

1 Worthington scuttlebutt circulating vertical duplex pump, 5¼ inches by 3½ inches by 6 inches.

2 Worthington fuel oil service vertical duplex pumps, 6 inches by 4 inches by 6 inches.

1 Worthington fuel oil transfer vertical duplex pump, 9 inches by 6 inches by 10 inches.

1 Worthington evaporator feed vertical duplex pump, 5¼ inches by 3½ inches by 5 inches.

1 Reilly feed water heater.

1 Reilly 30-ton evaporator.

1 Boiler feed double tube 2½-inch injector.

1 Auxiliary cylindrical condenser, 1,000 square feet.

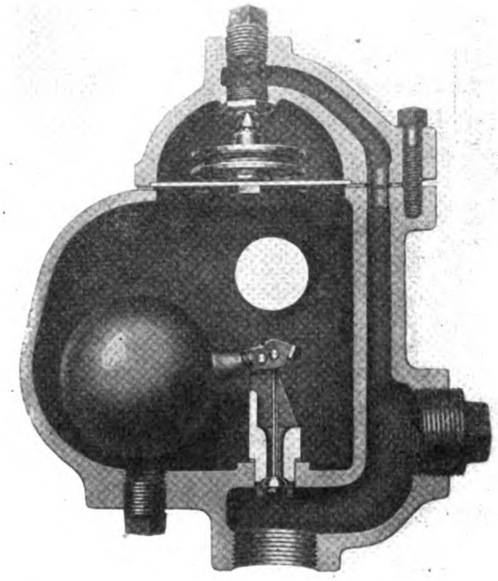
TRIAL RESULTS

On her trial trip the *Caracas* attained a maximum speed of 16.34 knots with the turbines developing 3,996 shaft horsepower. The average speed of the trial runs was 15.32 knots, with the propellers turning at 133.4 revolutions per minute and the turbines developing 3,965 shaft horsepower. The slip of the propeller was 11.5 percent, using the six nozzles on the turbines and full power.

The Webster Drip Trap

A NEW type of equipment manufactured by Warren, Webster & Company, Camden, N. J., known as the Webster drip trap, has been developed for use in connection with the Webster vacuum and modulation systems of steam heating which operate on pressures of 10 pounds per square inch and less. This trap is of the heavy duty type and is capable of handling large volumes of condensate and air while at the same time being light in weight, so that it may be readily mounted in the pipe line without other support.

The sectional illustration published herewith shows the method of construction of this trap which includes a float operated valve for the discharge of water and a thermostatic disk and valve for the discharge of air. Inlet openings on both sides of the trap are provided so that either right hand or left hand installations can be accommodated with the same model. Outlet openings on both the end and the bottom provide for the discharge of water or of water and air either horizontally or vertically to the nearest return line. An opening in the cover of the trap is provided so that air can be discharged separately to a dry return when desired.



Section showing construction of Webster drip trap

The weight of the trap complete is only 18 pounds, so that it may be handled easily either in shipping or installation.

FRENCH LINE TO BUILD NEW SHIPS.—The French Line is planning the construction of six new ships, one of them to be as large or larger than the *Ile de France*. Two of the other new vessels are to be cabin liners of about 20,000 tons, of the *De Grasse* type and probably motor driven, while three are to be motor driven cargo vessels of about 10,500 tons.

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Panama Pacific Liner California Launched

Newport News Shipbuilding and Dry Dock Company launches the largest electrically-propelled passenger ship in the world

THE launching on October 1 of the passenger steamship *California*, which the Newport News Shipbuilding & Dry Dock Company, Newport News, Va., is building for the Panama Pacific Line, a subsidiary of the International Mercantile Marine Company, New York, attracted unusual attention among shipbuilders and shipowners in this country and abroad, not only because this vessel is the largest passenger ship ever built in the United States, but also because she is the largest electrically-driven passenger vessel in the world. The vessel is scheduled for delivery in January, 1928. The *California* is the first of a fleet of 3 new vessels which the Panama Pacific Line is to place in its intercoastal service between New York and San Francisco via Havana and the Panama Canal. A contract for the second of these vessels was awarded to the Newport News Shipbuilding & Dry Dock Company on June 30, 1927, calling for the completion of the vessel on April 2, 1929. The second vessel will be practically a duplicate of the *California* except for an increase of 12 feet in length, the addition of ten tourist rooms and a different boiler room arrangement, 8 large boilers with inter-deck superheaters taking the place of 12 smaller ones in the first

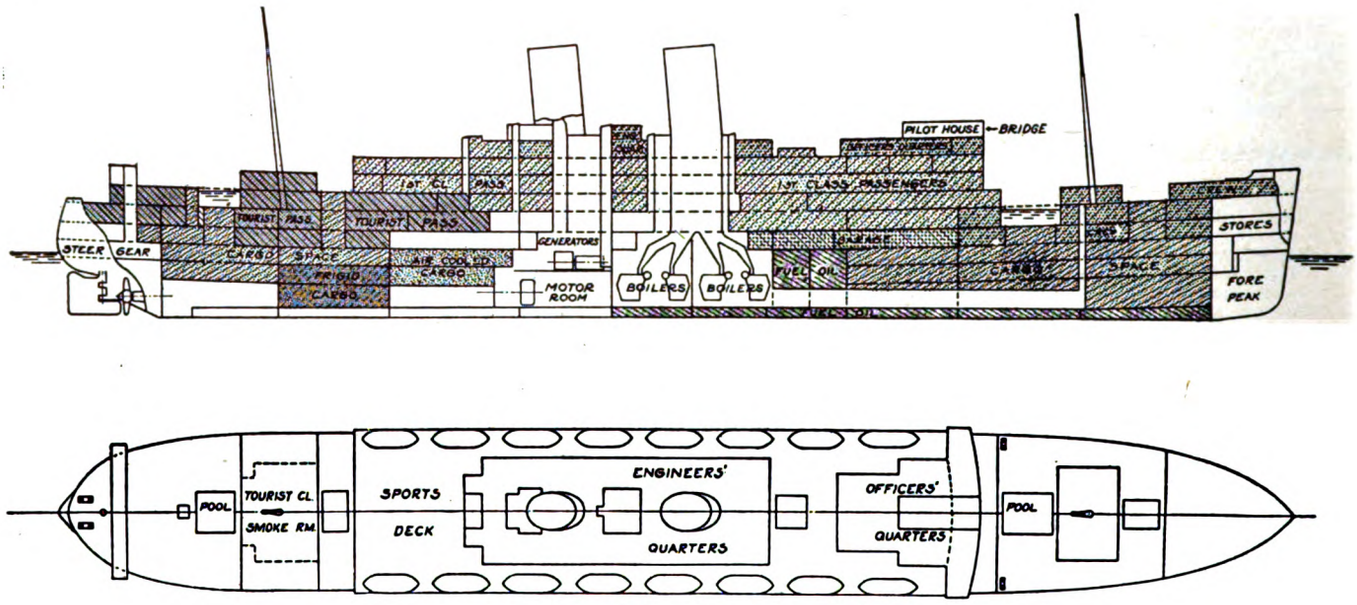
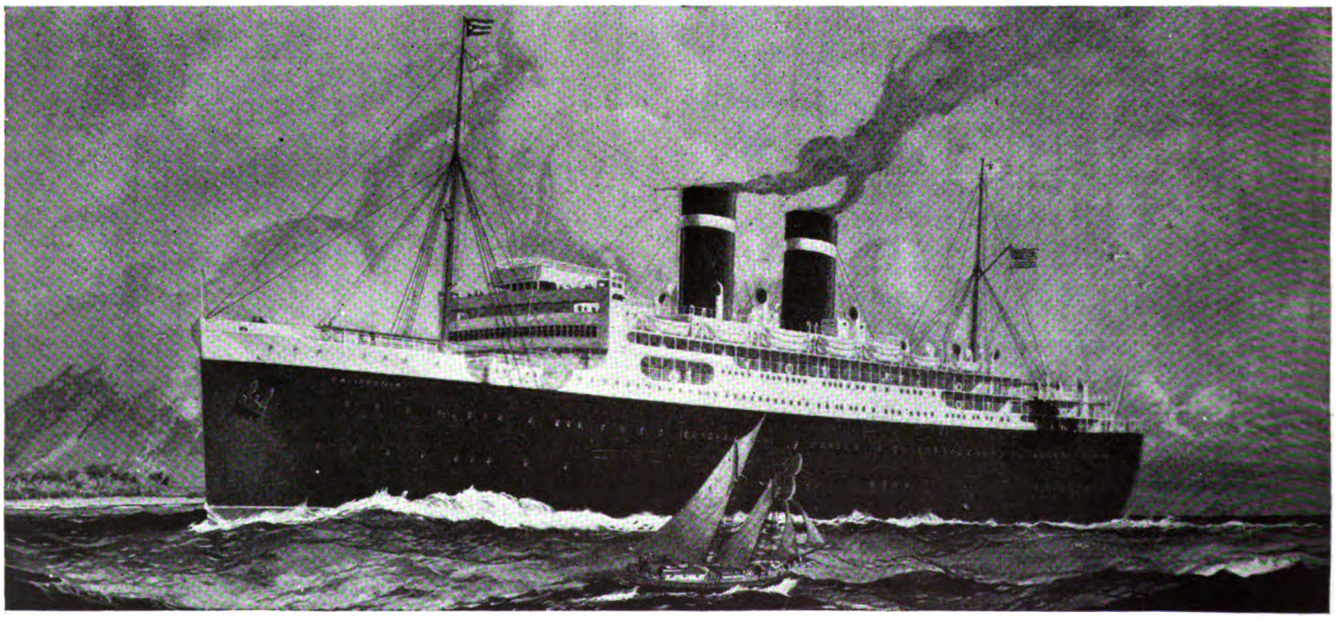


Diagram showing longitudinal section and weather deck plan of the California



Reproduction of painting by Worden Wood showing how the new Panama Pacific liner California will look when completed

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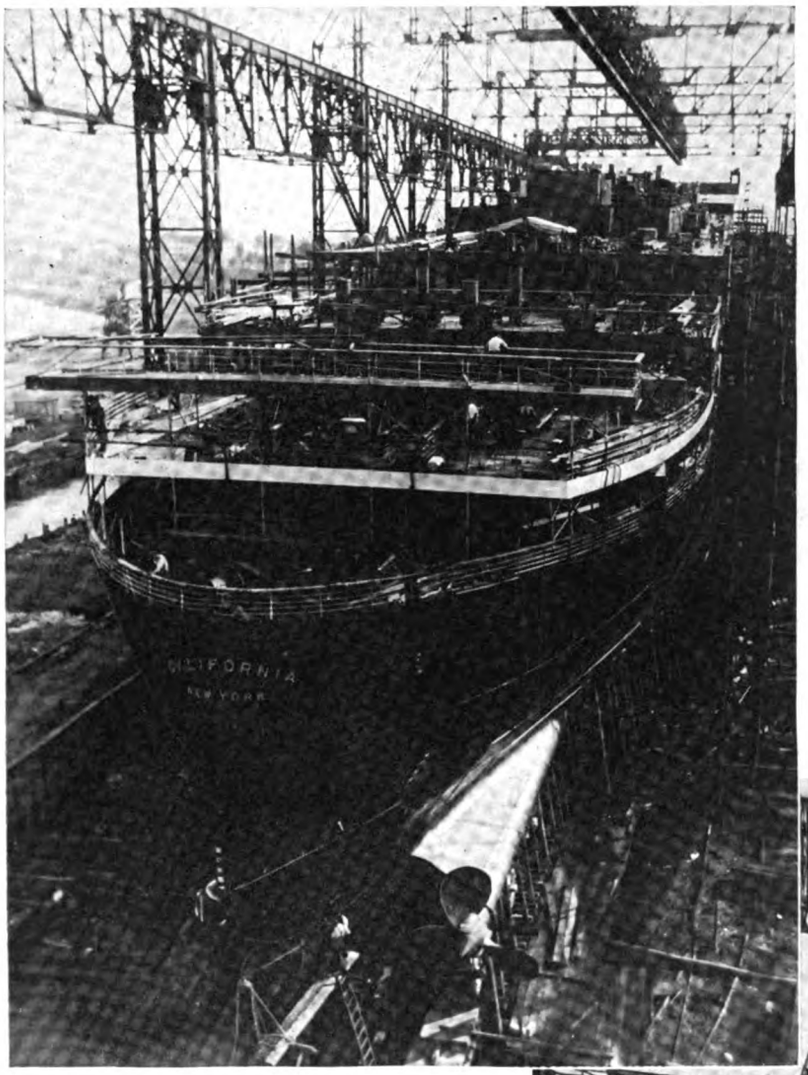


Stern view of the vessel

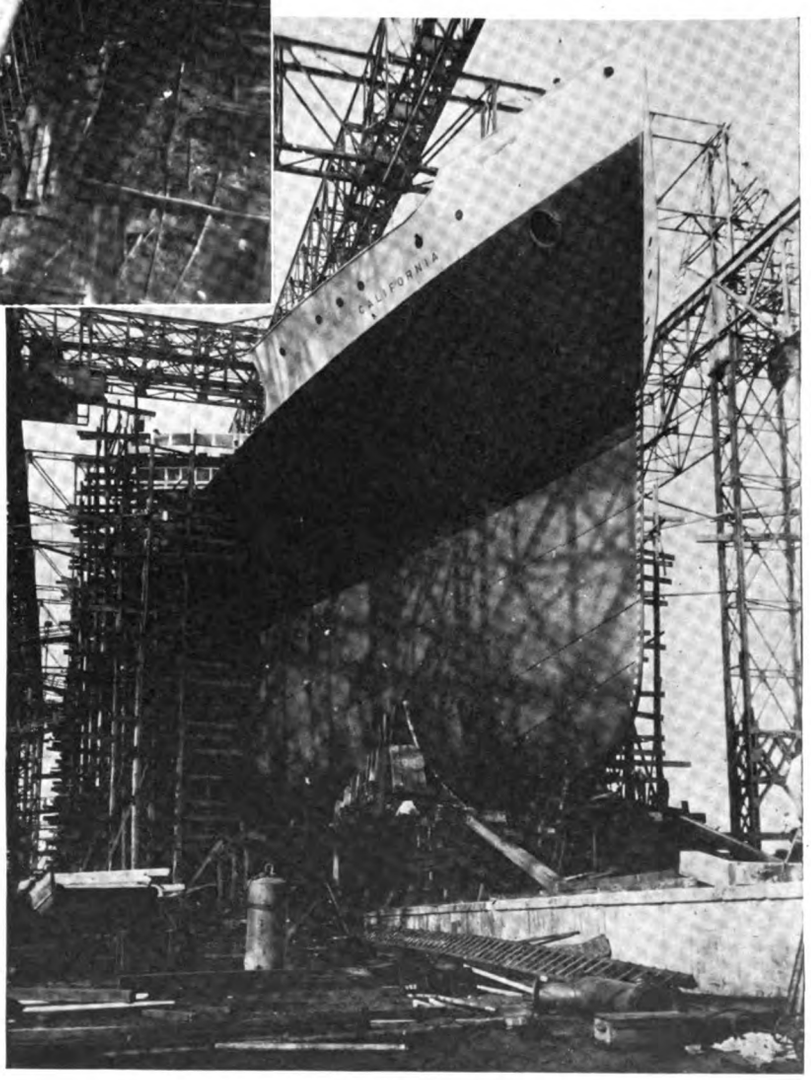
ship. The construction of a third ship for this run is under consideration by the International Mercantile Marine Company, although the plans have not as yet been disclosed.

The *California* is a twin screw vessel designed to carry both passengers and cargo, provision being made for handling a large amount of refrigerated cargo. Her extensive electrical equipment is being supplied by the General Electric Company, Schenectady, N. Y. She is being built to the highest classification of the American Bureau of Shipping and has the following principal characteristics:

Length overall	601 ft. 3 in.
Length between perpendiculars	574 ft.
Beam	80 ft.
Depth to shelter deck	52 ft.
Depth to upper deck	42 ft. 6 in.
Draft, load	32 ft. 3 in.
Displacement at load draft	30,250 tons
Deadweight capacity at load draft	15,300 tons
Shaft horsepower, maximum	17,000
Shaft horsepower at cruising speed	13,500
Designed speed	18 knots
Cruising speed	16.5 knots
Cruising radius	15,400 miles
Cargo capacity	478,700 cu. ft.
Refrigerated cargo capacity	100,000 cu. ft.
Fuel capacity	5,349 tons
First class passengers	384
Tourist passengers	363
Crew	350
Gross tonnage, about	21,000 tons

The hull is transversely framed with a cellular double bottom extending from the forward collision bulkhead to the after peak bulkhead. There are 8 decks designated from the top down as follows: Boat, promenade (A), bridge (B), shelter (C), upper (D), main (E), lower F and orlop (G). The shelter, upper and main decks are fully plated and the lower and orlop decks are partially plated. The hull is sub-divided by 11 transverse watertight bulkheads all of which extend to the shelter deck except 3 amidships which extend to the upper deck.

Only two classes of passengers will be carried—first class and tourist. The promenade deck will be given over to public rooms for first class passengers, including a library, lounge, lobby, smoking room and veranda cafe. The bridge deck will be given over almost entirely to first class staterooms, all of which are outside rooms arranged partly on the Bibby system, with



Bow view of the California

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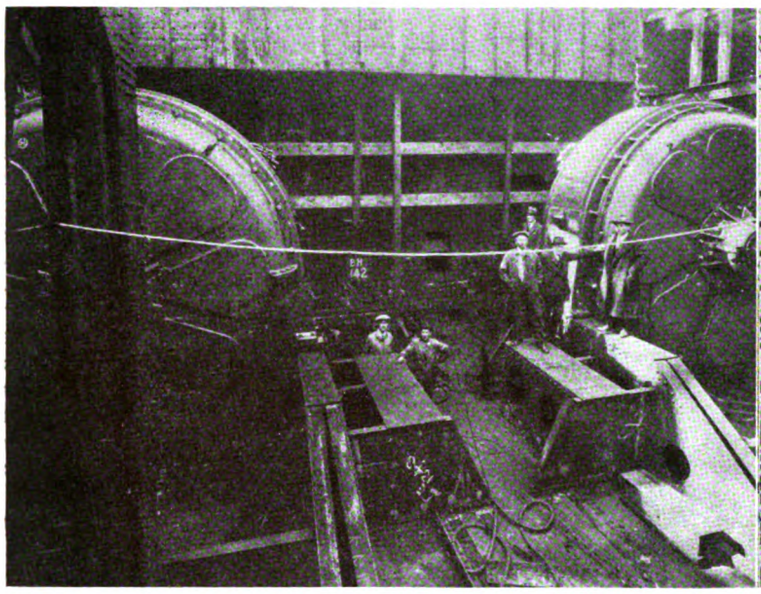
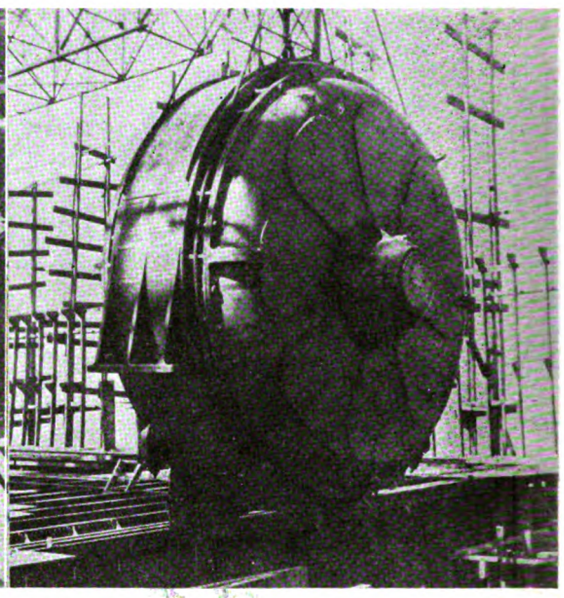


Propelling motors installed in engine room

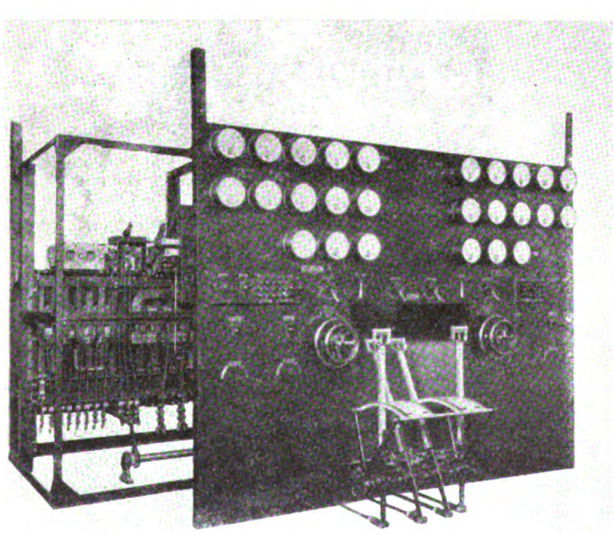


Lowering propelling motor into the ship

the tourist smoking room aft on this deck. Amidships the shelter deck will be taken up by first class staterooms with tourist staterooms and a tourist lounge aft. The first class dining room, galley, pantries and tourist dining room are located on the upper deck amidships. The public rooms will be furnished and decorated in the American colonial style. Two open deck swimming pools will be fitted, one forward on the shelter deck for first class passengers and the other aft on the bridge deck for tourist passengers.

The living quarters throughout the ship are in general ventilated with a mechanical supply system while a mechanical exhaust system is provided for the toilets, baths, smoking rooms, galleys and pantries.

The electrical plant for lighting and for power for the motor-driven auxiliaries and for exciting the propelling motors comprises four 500-kilowatt 240-volt direct current geared turbo generators and two rotary balancer sets. There are also two 15-kilowatt emergency generator sets. Three of the 500-kilowatt generators will probably take care of all requirements under over load conditions, leaving one generator for use as a spare or standby set.



Front view of the California's main electric propulsion control panel

The refrigerating machinery which supplies refrigeration to 60,000 cubic feet of cooled air space for carrying fruits and 40,000 cubic feet of frozen cargo space for meats, etc., consists of 4 Brunswick-Kroeschell CO_2 compressors each driven by a 100 horsepower 230-volt direct current motor.

Power for propelling the vessel will be derived from two Curtis type 16-stage impulse steam turbines, each rated at 6,750 shaft horsepower at 2,640 revolutions per minute and direct connected to an alternating current generator rated at 5,250 kilowatts at 2,640 revolutions per minute, 3,700 volts, 3-phase. Each turbine will have a maximum capacity of 8,500 shaft horsepower at 2,880 revolutions per minute, the capacity of the generators at this speed being 6,600 kilowatts at 4,000 volts. This power will be transmitted to the propeller shafts by two motors each being of the synchronous induction type rated 5,250 kilowatts at 110 revolutions per minute, 3,700 volts, 3-phase, 6,750 shaft horsepower. The maximum continuous rating of each motor is 6,600 kilowatts at 120 revolutions per minute, 8,500 shaft horsepower.

Steam is supplied by 12 Babcock & Wilcox oil-fired watertube boilers having a total heating surface of 55,176 square feet and a total superheating surface of about 16,000 square feet. The boiler pressure will be 275 pounds per square inch gage and the superheat 120 degrees Fahrenheit. The boilers are located three abreast in two boiler rooms. They will be operated under forced draft with double front furnaces equipped with Peabody burners.

There are two main condensers, each having 11,000 square feet of cooling surface and two auxiliary condensers, each having 2,800 square feet of cooling surface.

The propellers are of the 3-bladed manganese bronze built-up type 18 feet in diameter and 17 feet 9 inches pitch.

With this type of drive full backing power is available, no reversing turbines being required. Control is very simple, as only 3 levers are used in handling the vessel. Both propelling motors can be operated with the current supplied from a single generator when producing but three-quarters of its rated output, thus substantial economies may be effected when the vessel is operated at reduced speed.

A detailed description of the *California* and her machinery will be published in Marine Engineering and Shipping Age early next year.

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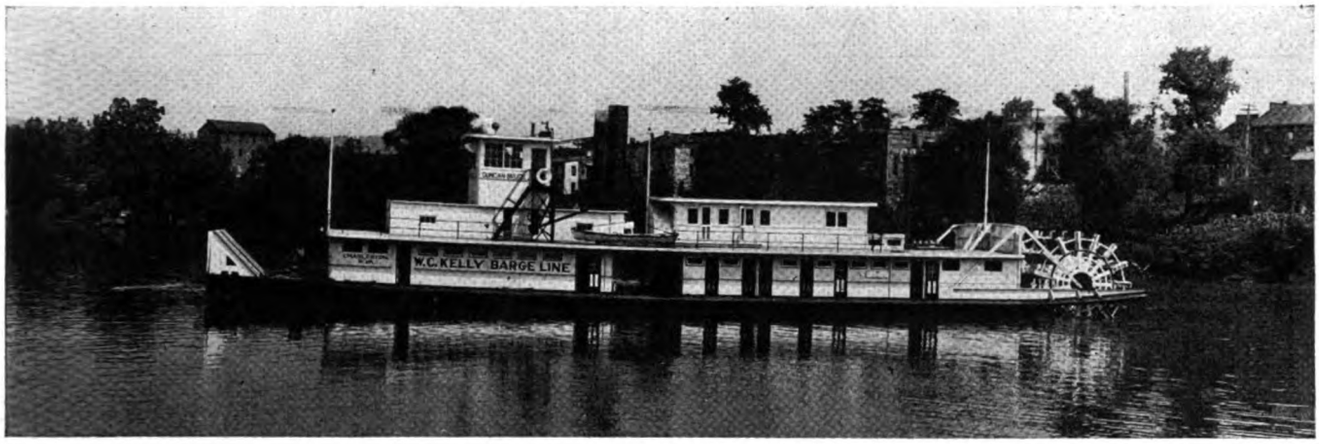

The Diesel tow boat Duncan Bruce equipped with two 360 horsepower Fairbanks-Morse engines

Diesel Tow Boat Duncan Bruce

Latest addition to W. C. Kelly Barge Line, built by Charles Ward Engineering Works

THE largest and most powerful Diesel-driven stern wheel tow boat on the Western rivers, the *Duncan Bruce*, designed and built by The Charles Ward Engineering Works, Charleston, West Virginia, for the W. C. Kelly Barge Line, was delivered to the owners in July, for service between Pittsburgh and New Orleans.

The *Bruce* completes a fleet of 4 Diesel-driven tow boats and 22 steel barges constructed by the Ward Works for the Kelly Barge Line.

PRINCIPAL DIMENSIONS

Length over all	160 feet 0 inches
Length between perpendiculars	135 feet 0 inches
Beam, molded	35 feet 0 inches
Beam, over all	36 feet 0 inches
Depth, molded	6 feet 0 inches
Sheer, forward	1 foot 6 inches
Sheer, aft	6 inches
Draft, aft	4 feet 3 inches
Draft, forward, fuel tanks full	4 feet 8 inches

The hull has a modified scow bow, long rake aft, and is of unusually heavy construction—much in excess of the American Bureau of Shipping requirements. Five longitudinal trusses and bulkheads provide excessive stiffness without the usual system of hog-chains so common on Western river steamers. There are 6 watertight compartments. The 4 fuel oil tanks have a total capacity of 20,000 gallons, or fuel for 400 hours continuous operation at full power, including the auxiliaries and galley range.

The forward deck space, 18 feet by 35 feet, is fitted with 2 motor-driven power capstans, 4 heavy towing knees, and the usual chocks, kevels and towing straps necessary for this type of tow boat.

The main deck house, 27 feet wide by 117 feet long, is of steel construction in two units separated by an open gangway 12 feet wide just aft of the engine room. Forward of the machinery space are 2 rooms for general stores and a commodious locker for engineer's stores.

The machinery space is 36 feet long and houses the entire power equipment. Aft of the main gangway are full quarters for a double crew, bath room, linen locker, mess room, large galley, refrigerator and cold storage. The gear and tiller compartments are after of the mess room and galley.

A large deck house on the upper deck has staterooms for the captain and radio operator, with connecting bath, and also luxurious quarters for the owner.

The pilot house, of steel 12 feet by 18 feet, is located above the engine room, and contains the regulation power and hand steering levers and pilot wheel, engine room telegraphs, searchlight controls, switches, tell-tale boards, and last, but not least, the beloved burnside stove—a necessary adjunct to all well regulated pilot houses, even though steam heated. A steel bridge on each side provides access to the pilot house and secure anchorage for boat cranes of 3,000 pounds capacity.

There are 2 Fairbanks-Morse 6-cylinder, full Diesel, solid injection, two cycle engines, each developing 360 brake horsepower at 250 revolutions per minute. The engines are fitted with air oil operated clutches and are coupled direct to the reduction gears through line shafts 6 inches in diameter. The operation of the engines is so smooth and positive that the clutches are used only for warming up.

The engine room floor and engine foundation, 3 feet 9 inches above the base line, provide deep girders and locate the line shafts and bearings below deck, leaving the entire deck space free for quarters and athwartship gangway. All auxiliaries, capstans and steering gear are electrically driven. Current is supplied by two 4-cylinder Hill full Diesel engines, each direct connected to 18-kilowatt generators. A single cylinder Diesel engine, belted to a 3-kilowatt generator, is used for stand-by service. Storage batteries of sufficient capacity to operate the steering gear in emergency also provide current for lighting, water service and refrigeration when the boat is in port. Hot and cold water is supplied by duplicate Fairbanks-Morse automatic service pumps. A Hyde electric steering gear is mounted on deck with limit switches located in the tiller room. Air and fresh water tanks of ample capacity are located below deck.

Successful performance of reduction gears for Diesel-driven stern wheel boats is dependent on the permanent alinement of the shafts and gearing, a condition extremely difficult to maintain with gearing mounted on the outboard end of the wheel shaft, as the wheel beams and fantails are

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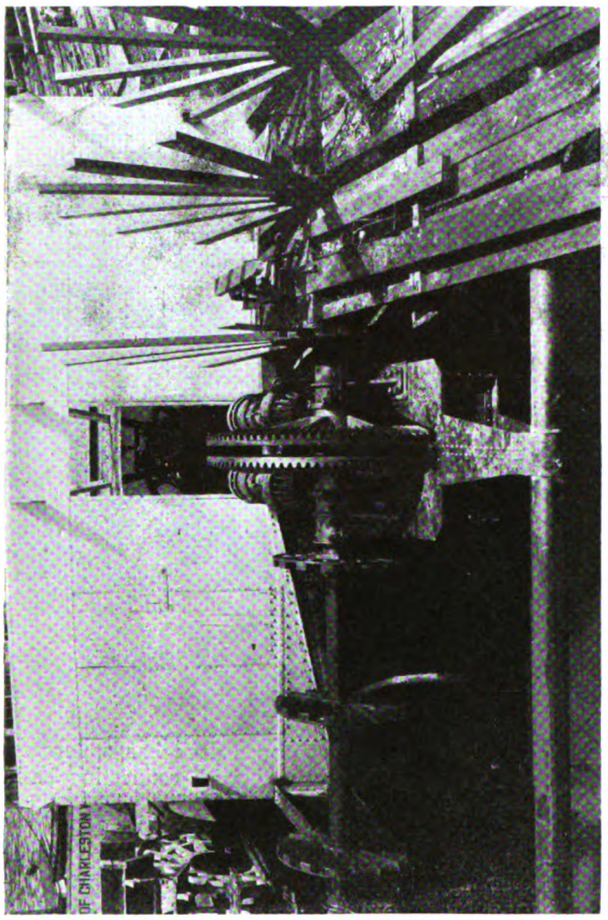
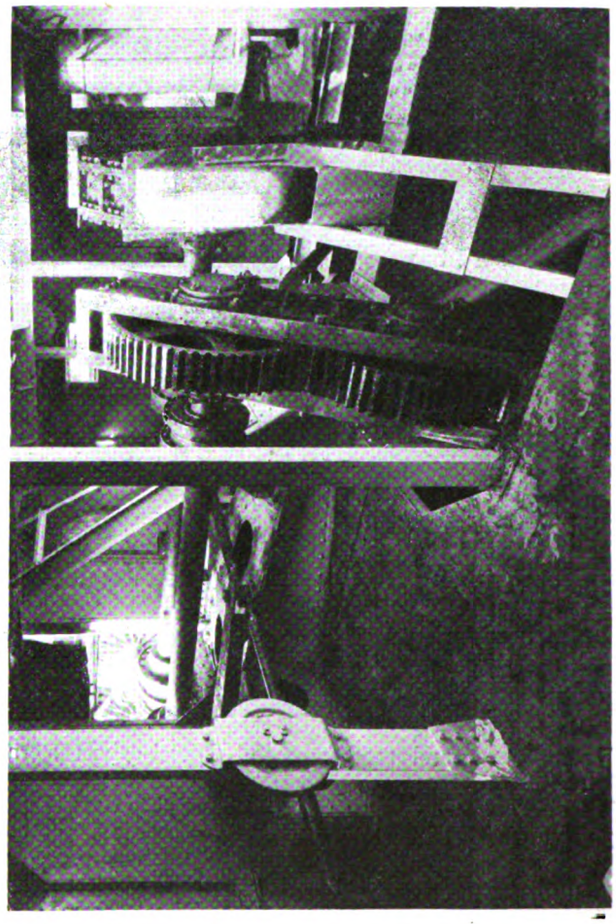
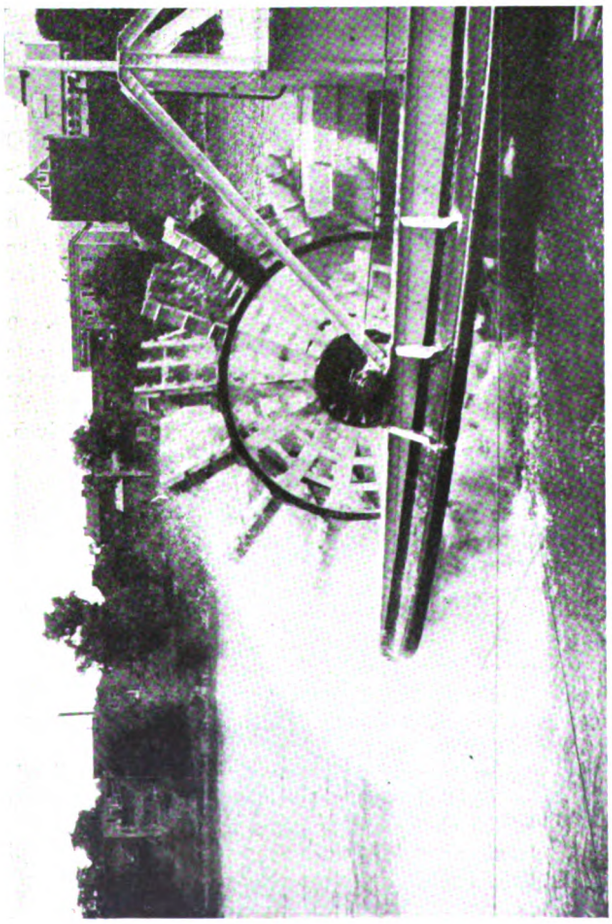


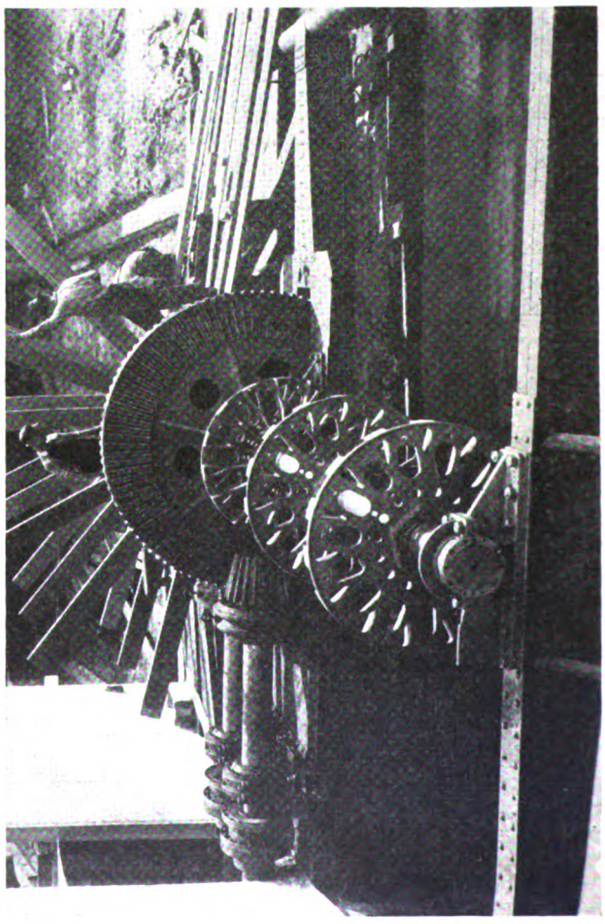
Stern view of the driving mechanism



Inboard reduction gears



Wheel turning 14 revolutions per minute at the bank



Side view of outboard driving mechanism

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subject to violent contact with lock walls, resulting in certain misalinement. The Ward reduction gear (patent applied for) entirely eliminates this difficulty, as the gearing is mounted on a wide beam or gear housing in the center between the independent stern paddle wheels. This beam is extremely rigid and may be considered as an extension of the hull; therefore the outside wheel beams and fantails are free to float on the wheel shaft in case of contact with lock walls or other objects, without the slightest movement of the gear housing.

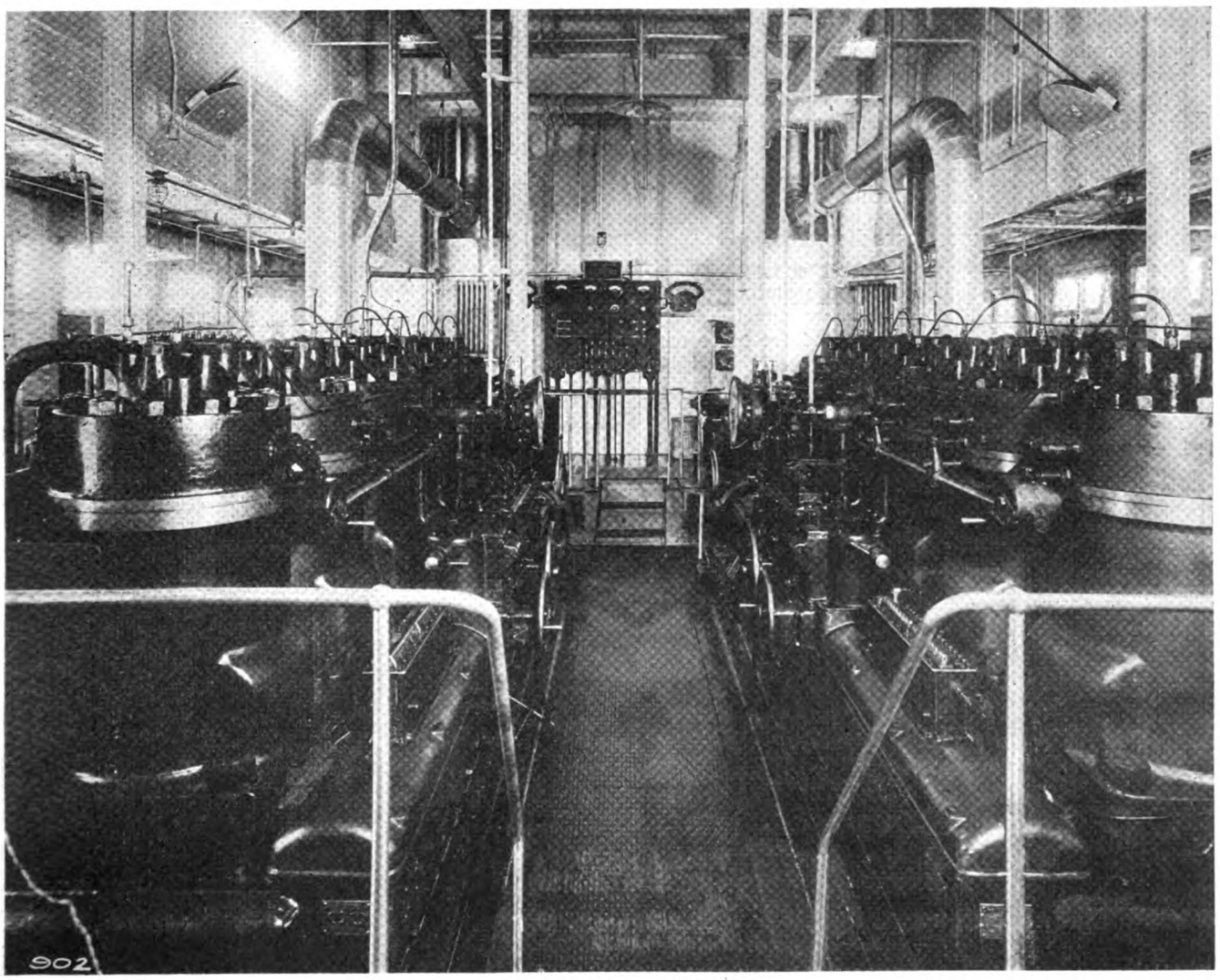
Both wheel beams and gear housing are designed to carry full loads and power transmission strains without the use of king posts and braces, the latter included in the original design to be fitted after all wheel and machinery weights were in place and lined up. These braces carry no active load, but act as shock absorbers for bucket slap, which always sets up vibration in the wheel beams and throughout the boat. The results obtained from this design are most gratifying. A coin will stand on the wheel beam when the boat is under full power.

The gearing is clearly shown by the illustrations. It consists of two separate reductions—large bevel gears placed back to back with a thrust bearing between the hubs. As the bevel pinions are mounted outside the large gears the transverse thrust is therefore self-contained and friction is eliminated at this point, as both wheels are revolving in the same direction.

The pinion shafts are mounted in 4 extra-large S. K. F. self-alining roller bearings, and the end thrust is carried on special S. K. F. combination radial roller and ball thrust bearings. Floating shafts, with Poole flexible couplings, connect the forward end of the pinion shafts to the second reduction gears. These units are mounted on an A-frame foundation, thus providing suitable distance between the line shafts, as shown by the illustration.

S. K. F. self-alining roller bearings are used for all gear shaft bearings. The gears are inclosed in oiltight cases and run in special gear lubricant. The wheel shafts revolve in plain bearings with removable bronze sleeves lubricated by mechanically operated forced-feed lubricators.

There are two stern wheels, each 18 feet in diameter, with 15 buckets. The wheels can be operated independently in either direction, producing unusual maneuvering ability when handling the boat in restricted quarters. With the right combination of wheels and rudders the boat can be moved sidewise without forward or astern motion. This peculiar condition is more or less freakish and of no value in handling heavy tows, as the flanking power of the 4 large balanced rudders, when both wheels are backing, is more than double the twisting action produced by operating the wheels in opposite directions. Under operating conditions the wheels should revolve as a unit in the same direction and at equal speeds.



Engine room of the Duncan Bruce, looking aft

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The engineering department of the Ward Engineering Works is to be congratulated on the general design and accuracy of the weight and trim calculations. The photograph of the vessel reproduced on page 557 shows the perfect trim and wheel immersion.

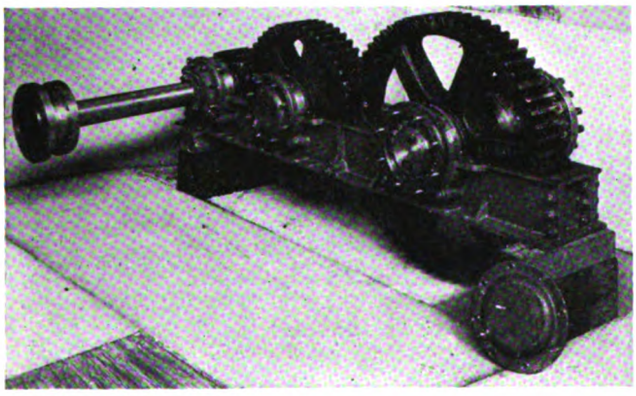
TESTS CARRIED OUT

Within one hour after the engines were tuned up a series of continuous full power dock and dynamometer tests were run. During these tests there was not the slightest indication of trouble or stress in bearings, gearing or engines. The wheel design is from model experiments conducted at the Experimental Basin, Washington. The Charles Ward Engineering Works has conducted a series of self-propelled model tests in the tank, and the *Duncan Bruce* demonstrates for the fourth time the value of such data, particularly for Diesel-driven boats.

This information, combined with additional tests now being made and trial records extending over a number of years, places the builders in possession of a vast fund of data for the design and construction of the unique type of tow boats required for our Western rivers.

OPERATING COSTS REDUCED

Operating costs on the Western rivers are reduced to the minimum by the use of Diesel engines and properly designed boats, either stern wheel or screw tunnel. The saving in fuel and labor over that required for triple expansion steamboats, using oil for fuel, represents a substantial profit.



The reduction gear

The twin screw Diesel tow boat *George T. Price*, built by The Charles Ward Engineering Works, with 720 shaft horsepower, has a record of 10,000 revenue-producing ton-miles per barrel of fuel oil consumed, compared with 3,200 ton-miles per barrel of oil burned on twin screw triple expansion condensing steamers of approximately the same shaft horsepower and in the same service. This information is taken from the operating costs of the Federal Barge Line during the period that the *George T. Price* was chartered by them. To this must be added the wages and sustenance of at least 2 men not required on the Diesel-driven boat.

That river operators realize the economy of Diesel engines is evidenced by the great interest displayed in each new boat and the increasing demands for boats of this class. There are now under consideration 2 or 3 Diesel river boats of over 1,000 horsepower each.

The Diesel engine boats built and under construction by The Charles Ward Engineering Works have an aggregate horsepower probably equal to, if not in excess of, the total installation of all the other prominent yards on the Western rivers combined.

Trial Trip of Diesel Tug New Rochelle

A DEMONSTRATION trial trip was recently held in New York harbor of the Diesel tug boat *New Rochelle*, built by A. C. Brown & Sons of Tottenville, Staten Island, New York. The tug boat was designed by Merrit Demarest, naval architect for this firm. The trial was made from Pier A, New York city, to College Point, the boat proceeding around lower Manhattan up the East river through Hell Gate to the plant of the College Point dry dock, after which the inspection party returned to New York city.

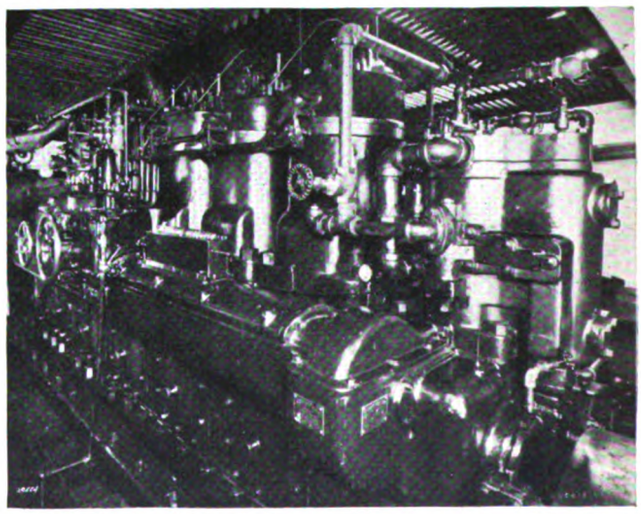
The tug boat is of wooden construction and special care was taken in the design of the engine room to allow ample space for the main engine and auxiliary machinery.

The Diesel tug New Rochelle

The principal characteristics of the *New Rochelle* are:

Length overall	84 feet
Beam, molded	21 feet 6 inches
Depth, molded	9 feet 7½ inches
Load draft	9 feet 3 inches
Displacement	193 tons

The main propulsion unit consists of a 6 cylinder Fairbanks-Morse full Diesel marine type direct reversible engine developing 360 horsepower. This engine operates on the 2 cycle principle and solid injection.



Main engine of the New Rochelle

The auxiliary machinery includes a two cylinder 12 to 14 horsepower Hill Diesel engine connected through a clutch to a 5-inch by 2¼-inch by 4-inch two-stage Ingersoll-Rand air compressor having a capacity of 21 cubic feet of free air per minute at 350 pounds pressure. This engine is also connected through a chain drive to an 8-kilowatt 125-volt direct current generator. It is also used

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to drive through a clutch connection a Northern rotary type fire pump having a capacity of 175 gallons per minute at 75 pounds pressure.

The steering gear, which is of the hydraulic type, was supplied by the American Engineering Company, Philadelphia, Pa. The boat is driven by a 3-bladed, bronze propeller having a diameter of 76 inches and a pitch of 46 inches. The fuel capacity in the main tanks of the tug boat is 8,238 gallons; in the lubricating oil tanks, 258 gallons, and in the water tanks, 516 gallons.

Inclining Experiment—U. S. S. Utah

By Lieut. Commander G. C. Manning, C. C., U. S. N.

THE May, 1927, issue of MARINE ENGINEERING AND SHIPPING AGE gave an account of an inclining experiment conducted on the battleship *Florida,* subsequent to modernization, which was somewhat unique for United States naval vessels in that water was admitted to some of the blister compartments to obtain the desired inclinations. The reasons for the use of a liquid, usually looked upon with disfavor by naval architects, in that particular case were a large value of the transverse metacentric height of this vessel combined with large displacement giving very high values for the moment required to produce an inclination of the desired amount. Similar conditions obtained on the *Utah,* the *Florida's* sister ship, resulting in a decision to incline this ship in a similar manner.

In view of the complete success of the *Florida's* inclining experiment, we contemplated the *Utah's* experiment with more confidence, and made some changes in the procedure which resulted in giving a better balance of values for the metacentric height, and reduced the time required for performing the experiment appreciably.

The procedure in the case of the *Utah* was as follows:

(1) Flood one port tank.
(2) Flood another port tank.
(3) Flood three starboard tanks.
(4) Flood a fourth starboard tank.

This gave two port and two starboard inclinations, and the port inclinations obtained in steps one and two were respectively very nearly equal to the starboard inclinations obtained by steps three and four.

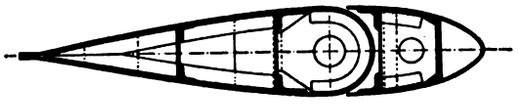
When an effort was made to slacken the mooring lines to take the initial readings before giving the ship the first inclination, it was found that although the breeze appeared very slight, the ship moved to take up the slack about as rapidly as the lines were payed up. After the mooring lines had been thoroughly slackened, and there was a space of several feet between the ship and the pier, a tug was used to breast the ship over until she touched the pier. The tug then backed rapidly, and a signal was given to the observers to note and record the readings of their pendulums while the ship was floating freely. This procedure was repeated for each reading. It resulted in speeding up the experiment as well as reducing the labor required for handling lines.

As in the case of the *Florida,* draft readings forward, aft, and on both sides amidships were taken every time the pendulums were read, and approximate values of the metacentric height were computed during the progress of the experiment, to give warning of any unusual variation which might indicate errors in the observed data. The four values of the transverse metacentric height obtained in this experiment were in very close agreement. This fact, fortified by the excellent results obtained in conducting the inclining experiment on the *Florida* in a similar manner, indicates that this method is entirely satisfactory if proper precautions are taken and the loss of metacentric height due to free surface is negligible.

The Oertz Streamline Rudder

THIS new invention has been widely recognized as a very important improvement in shipbuilding and has been installed on, or ordered for 175 steamers, aggregating a total of more than 900,000 deadweight tons, all within a period of slightly over two years.

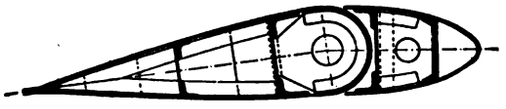
The principle on which the construction is based has been derived entirely from experiences in aviation. It is the fact that a comparatively thick wing profile gives the best proportion between lifting power and resistance in longitudinal direction. When applied to the rudder of a ship this means a maximum steering effect with a minimum of resistance. In order to retain this favorable wing profile, at extreme angles of helm, the rudder is made in two parts, of which the parabolically rounded forepart is constructed



Cross section of Oertz streamline rudder

as a fixed guide body around an existing rudder post, or in a new ship as a specially formed rudder post; while the afterpart of the rudder, the actual turning part, joins the fixed forepart in a complete streamline form.

The axis of the movable back part lies at about one-third of the total length from the forward edge in consequence of which such a distribution of pressure is obtained, that the rudder requires only from 50 to 70 percent of the steering power needed for a normal plate rudder of the same dimensions. Through this construction in two parts, not only is an ideal streamline



Cross section of rudder with helm at an angle

profile retained at every angle of helm but the propeller stream is leveled and straightened behind the ship and a very quiet wake produced, which means a considerable decrease of resistance and a consequent increase in the speed of the ship.

Another important feature of this rudder construction is the fact that the ship is very easily held on a steady course and yawing is largely overcome. The captains' reports from the numerous ships which have been equipped with this rudder, make mention not only of a considerable improvement in the maneuverability of the ship but also of the ability of the rudder to keep a straight course.

Furthermore, it is claimed that a saving in horsepower ranging from 8 to 16 percent has resulted from its use and that vibration in the stern of vessels, so frequently occurring with plate and other rudders, is almost completely eliminated by it.

Leading steamship operators abroad, such as the Hamburg American Line, North German Lloyd, Woerman and German East Africa Line of Hamburg, Nederland Steamship Company of Amsterdam, Holland, Rotterdam Lloyd Steamship Company and Van Ommeren Shipping Company of Rotterdam, now have anywhere from 6 to 13 vessels equipped with the Oertz rudder while in this country the Standard Oil Company of New Jersey has taken the lead with an installation on the S.S. *H. M. Flagler.*

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German Double Acting Diesel Engines

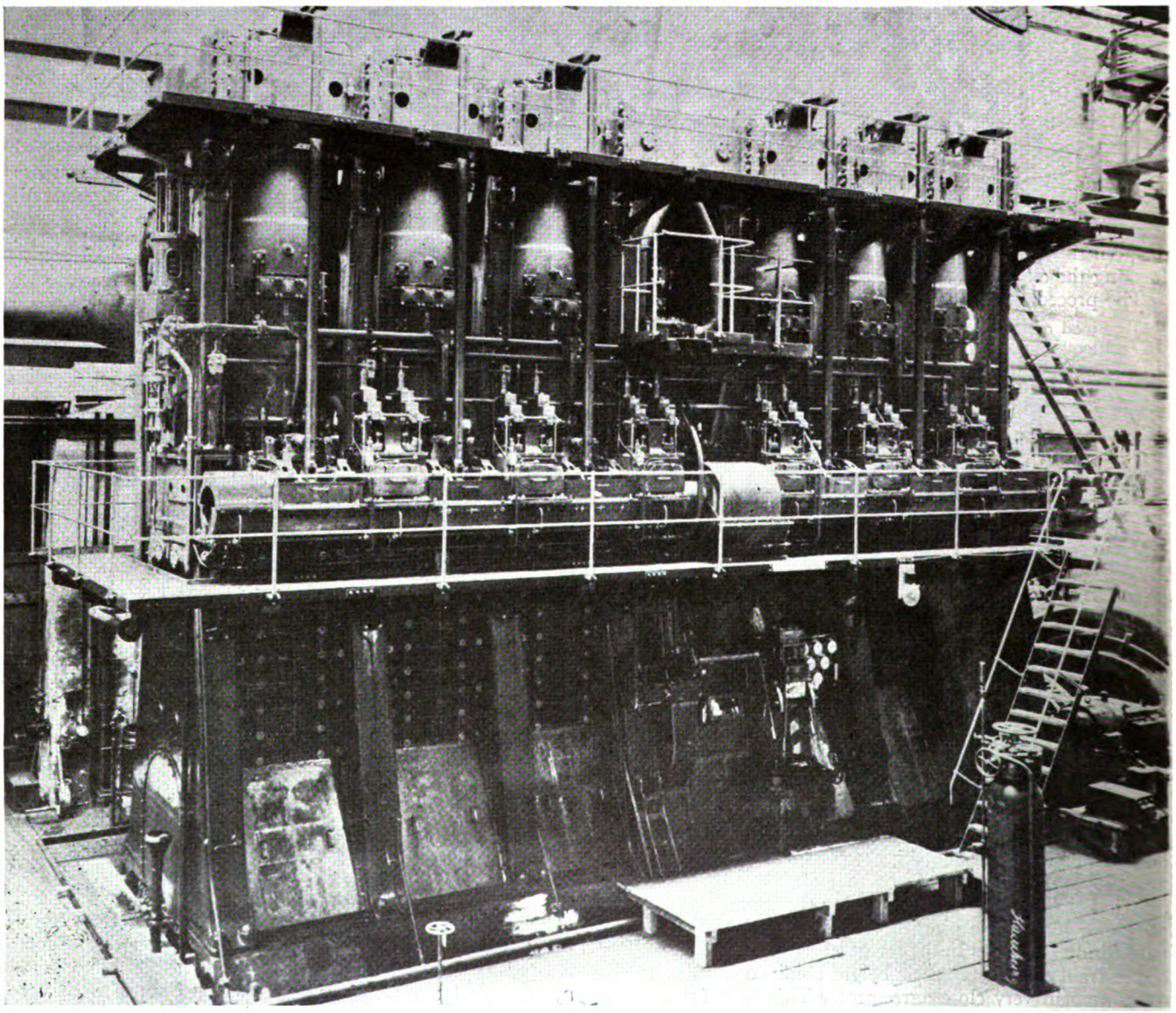
New types of Diesel engines which are displacing single acting machinery in the German shipyards

By Our Special London Correspondent

GENERALLY speaking, it is perhaps true to say that more interest is being concentrated throughout the whole world on the development of the double acting engine than of the single acting type which most engineers appear to consider to have reached its limit; but it is in Germany alone that double acting motors are already being built in larger numbers than those of other types.

The course of development of marine oil engine design in Germany is worthy of examination. Two cycle and four-cycle, single acting machinery was built before the war, and the first double acting, two stroke engine ever fitted in a ship was constructed and installed in Germany just before the outbreak of war. After the conclusion of hostilities, however, all the leading manufacturers appeared to think that as most experience had been gained with the four stroke, single acting type, it was better to build such engines and the large firms such as Krupps, the M. A. N. and the A. E. G. worked along these lines. In fact, at the A. E. G. in Berlin, four cycle, double acting Burmeister and Wain engines were standardized on a very extensive scale.

About two years ago, the double acting, two stroke engine came into prominence, and so rapidly has it grown in favor that there are more ships, both passenger and cargo, now under construction in Germany fitted with such plant than vessels equipped with any other class of internal com-



4,500 brake horsepower, double acting engine installed in the Rheinland, the first of 18 motorships building for the Hamburg American Line

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bustion machinery. The Hamburg Amerika Line in particular has shown its preference for double acting motors. With largely increased capital it has inaugurated a building program involving the construction of about 22 new ships of which 18 are to be propelled by internal combustion motors. Of these, 12 or 14 are to have double acting units, three being of the new A. E. G.-Hesselman type and the remainder the M. A. N. design.

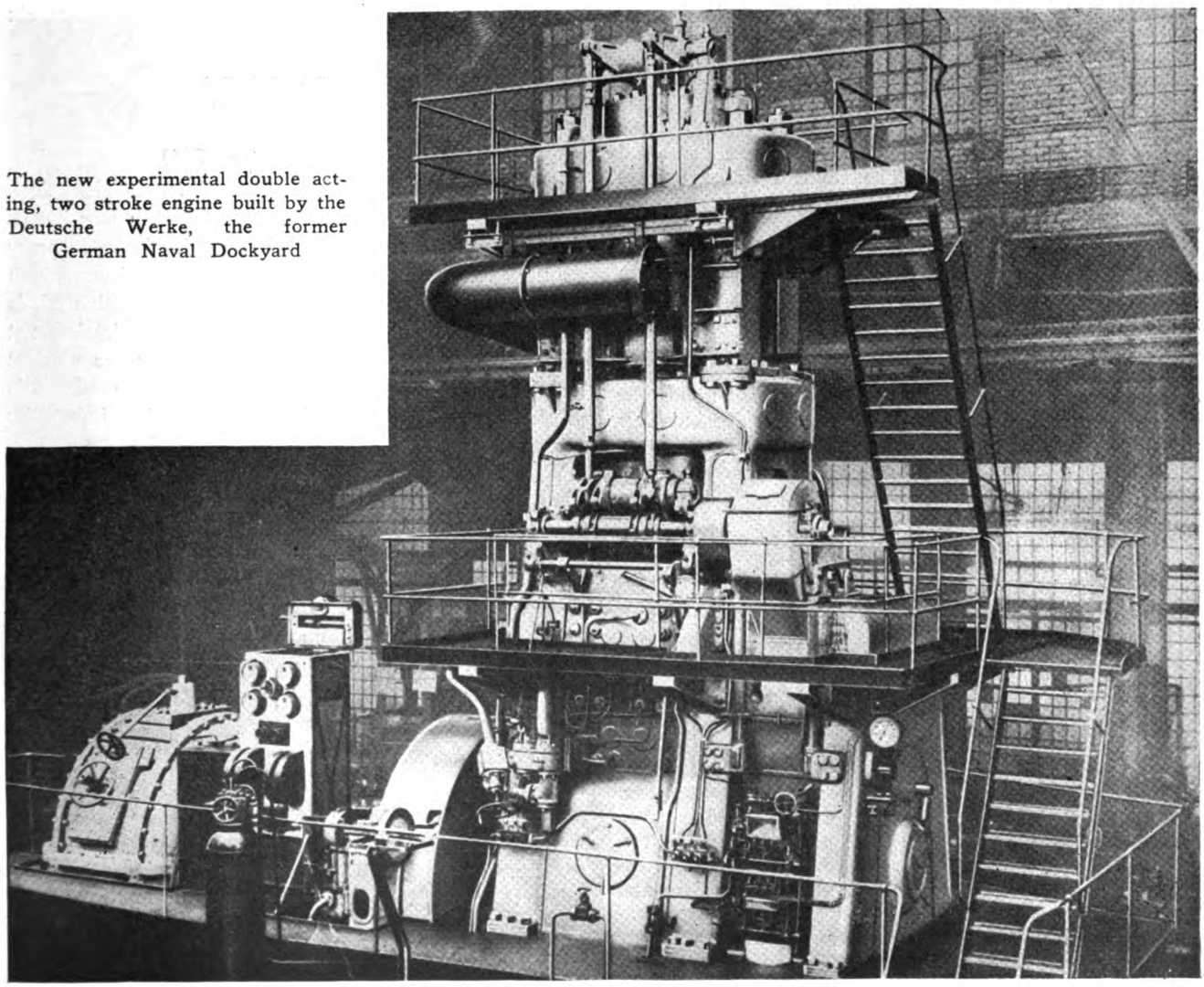
The first ship under this new program has just been completed. It is the cargo carrier *Rheinland* intended for the Australian service, and carries 10,100 tons deadweight, being 450 feet in length, with a beam of 59 feet 11 inches. The machinery installation is of exceptional interest, for it indicates the attention which some owners are paying to the possibilities of standardization in Diesel motor construction.

It is a 6 cylinder M. A. N. double acting, two stroke type, designed to develop 4,500 brake horsepower at 86 revolutions per minute and having six cylinders, 600 millimeters bore with a piston stroke of 1,400 millimeters. Nine more of the new Hamburg Amerika Line cargo or mixed cargo and passenger ships are to have similar machinery, but owing to the variation in size and speed, the power needed ranges from just under 4,000 up to 5.400 shaft horsepower. In order to retain the same cylinder size throughout, however, it was decided to adopt similar engines but with different numbers of cylinders, with the result that, in some cases, 5 cylinder motors have been used, in others 6, and in two vessels, 7 cylinder plant will be installed. In their various ships, therefore, the owners will have engines totalling over 50 cylinders, identical in all respects. The advantage which thus accrues in connection with the question of spare parts and overhaul is obvious, while engineers can readily be taken from one ship to another, and remain completely familiar with the machinery.

For three of their new vessels, the Hamburg Amerika Line have ordered double acting, two stroke motors of the A. E. G.-Hesselman design which has not yet been fitted for marine work. This would seem to indicate that little hesitation is now shown in adopting Diesel motors of new types, although it should be added that prolonged experimental work was carried out in the A. E. G. factory at Berlin when the order was placed.

The new motor will be the first double acting, two stroke unit to have airless injection (the Richardson-Westgarth type has not yet been installed in a ship) and remarkably low fuel consumptions are claimed. In each of the three ships mentioned, there will be a 6 cylinder motor developing 4,500 brake horsepower at 86 revolutions per minute and, incidentally, it may be noted that practically all the new cargo tonnage for the Hamburg Amerika Line is represented by single screw vessels with a machinery speed of no more than 85 to 90 revolutions per minute—a decidedly low figure for Diesel motors.

The machinery of the two 17,000-ton passenger liners *St. Louis* and *Milwaukee* which are being built for the



The new experimental double acting, two stroke engine built by the Deutsche Werke, the former German Naval Dockyard

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Hamburg Amerika Line's New York service, with a speed of 16½ knots, is of peculiar interest, and some particulars of this have already been made public. There will be four double acting, two stroke motors in each ship developing a total of 12,400 brake horsepower and running at 230 revolutions per minute but they will gear on to two propeller shafts turning at 110 revolutions per minute. It is a curious fact that while there will soon be five large German passenger liners in service equipped with geared Diesel machinery, no shipowner in any other country in Europe has thought fit to adopt this arrangement, which, if successful, has many advantages.

In addition to the A. E. G.-Hesselman and the M. A. N. designs two other types of double acting, two stroke engine are now being built in Germany. No attention is, however, being devoted to double acting, four stroke motors which are the most popular in the United Kingdom and Scandinavia. The interest of the German Government in this problem may be inferred from the production of a double acting, two stroke engine at its old Naval Dockyard at Kiel, which now forms the Deutsche Werke, and in which the German Government has a big financial, if not a controlling, interest.

An illustration of the Deutsche Werke experimental motor is given, and trials are about to be run of the first 6 cylinder engine of this class. Four are under construction, for two twin screw cargo ships for the Norwegian owner Ivar An Christensen, both of which, it is claimed, will attain a speed at sea of 16 knots. The engines are designed to develop about 4,000 brake horsepower each in six cylinders, 650 millimeters bore with a piston stroke of 900 millimeters and they run at the relatively high speed of 125 revolutions per minute. They use air injection and scavenging air is supplied from separate electrically operated blowers.

The remaining double acting engine of German design is that of Krupps, which has, however, only been developed in the experimental stage. The single cylinder unit is capable of an output of about 1,800 indicated horsepower, or approximately 1,400 brake horsepower. It includes no unusual features in design, except that, as a result of recent investigations, it has been decided that a hydraulic system of operating the fuel valves presents advantages over the normal arrangement in which the cam shaft is utilized for this purpose.

Taking a survey of the present position of marine Diesel engine manufacture in Germany, the conclusion must be reached that the double acting, two stroke engine bids fair to gain almost universal application for moderate and large powers, while for smaller units, say up to 1,000 horsepower, the new airless injection four cycle, single acting type, now built by several firms, will be widely used. It must be admitted, however, that a number of two cycle, single acting engines of the Sulzer, Krupp and M.A.N. types are still being built and it may be that, after gaining further experience, owners will yet revert to them on a larger scale.

New Low Speed Synchronous Motor of Arc Welded Construction Developed by Westinghouse

A NEW low speed synchronous motor, called the type HR, has recently been placed on the market by the Westinghouse Electric and Manufacturing Company. This motor is claimed to be the most modern and highly developed drive yet devised for slow speed machinery where direct connection is applicable. While arc welding has been used to some extent in Westinghouse motors for 15 years, it reaches its greatest application in this motor. Its parts have been specially designed for ease in handling and ease in assembling in the field.

This motor has been designed for high efficiency at all loads within its normal operating range. High efficiency at fractional loads is a great power saver since few applications require the maximum output of the motor. The excitation has been materially reduced, thus increasing the efficiency and cutting operating costs. A difference of 1 percent in efficiency on a 200 horsepower motor running 24 hours a day for 250 days a year means a difference of $250 with power at 3 cents a kilowatt.

A starting torque of 50 percent and a pull in torque of 40 percent are features of this new motor. The higher the starting torque, the quicker the motor will come up to normal running synchronous speed. The disturbance on the line is correspondingly reduced. This higher-than-usual torque is also a valuable asset under such unusual conditions as starting a machine while it is still new and stiff or after it has been standing for a considerable time.

Low speed motors naturally have very little windage effect so that cooling is effected largely by radiation. As heat has a deteriorating effect on insulation, a cool running motor will have a long life. The shape of the rotor arms in this new motor is such that a large amount of air is set in motion. This cooling air is so directed that it not only passes through the stator coils but it also passes over a large area of the stator laminations as well.

A means of varying the flywheel effect is an attractive feature of the new, type HR, synchronous motor. By means of different weight rings bolted to the rotor rim, six possible values of flywheel effect are available.

Ship Conversion

(*Continued from page* 542)

There can be no denying that oil is an ideal fuel, whether burned under boilers or in engine cylinders, but its availability is, in certain localities, restricted, the economy resulting from its use is dependent upon the price at which it an be obtained and the latter, more than with coal, is subject to manipulation. Apparently pulverization not only makes ordinary bunker coal a much more efficient fuel, but also makes possible the use of low grade coals which hitherto have not been considered suitable for marine use.

While it may be impossible to devise any form of steam plant which will equal the Diesel on a pound of fuel per horsepower hour basis, when the possibilities of a combination of low grade, low priced fuel with a modern high grade steam plant are considered, together with the lower price of this installation as compared with the present price of internal combustion machinery, one cannot but feel that for anything except perhaps the extreme long voyage trades steam will have to be reckoned with for many years to come.

The first chapter of the conversion program has given to the Shipping Board some really competitive and highly useful motorships and steps are now being taken to add to their number. It is sincerely to be hoped that the board will leave no stone unturned in its efforts to acquire an efficient fleet and that the builders of steam machinery may now be given an opportunity to demonstrate their ability to contribute to the desired end.

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Tests of Hamilton-M. A. N. Diesel Engine

Results of shop tests of Hooven-Owens-Rentschler engine constructed for Shipping Board Diesel conversion program

AS a part of the Shipping Board Diesel conversion program, the Hooven-Owens-Rentschler Company, Hamilton, Ohio, built a double acting two cycle Hamilton-M.A.N. Diesel engine for installation in the 9,600-ton cargo ship *Seminole*. The engine was designed to develop 3,300 horsepower at 95 revolutions per minute or 4,500 horsepower by running the engine at maximum speed.

This engine has 4 cylinders each 27½ inches diameter by 47¼-inch stroke. In addition, there is driven direct from the crank shaft a 3-stage compressor for air injection and a twin scavenging pump for scavenging the exhaust from the main cylinder. The details of construction of this engine were fully illustrated and described on page 84 of the February, 1927, issue of MARINE ENGINEERING AND SHIPPING AGE. The results of the shop test of the engine are as follows:

SUMMARY OF SHOP TEST

Date of test—January 13 to February 12, 1927.
Location—Hamilton, Ohio.
Builder—Hooven-Owens-Rentschler Company.
Type of engine—2-cycle double acting air injection.
Auxiliaries attached—air compressor and scavenging pumps.
Rated brake horsepower—3,300.
Number of working cylinders—4.
Diameter of working cylinders—27.5 inches.
Stroke of working cylinders—47.25 inches.
Diameter of main piston rods—9.25 inches.
Diameter of compressor cylinders.
L.P. stage—33.5 inches. I.P. stage—29.5 inches.
H.P. stage—7.125 inches.
Stroke of compressor cylinders—25.5 inches.
Diameter of compressor piston rod—5.875 inches.
Number of scavenging pumps—2 double acting twin.
Diameter of scavenging pumps—45 inches.
Stroke of scavenging pumps—55 inches.
Diameter of scavenging pump piston rods—5.875 inches.
Capacity and characteristics of generators—2.1250 k.w., 260 volts, compound wound.

30-DAY TEST DATA AT FULL LOAD

	Maximum	Minimum	Average
Barometer	30.28	29.40	29.73
Pressure, injection air	1,098	1,064	1,080
Pressure, jacket cooling water	33.8	30.9	32.8
Pressure, piston cooling water	43.5	37.4	39.5
Pressure, lubricating oil	31.5	25.4	29.1
Pressure, scavenging air	2.6	2.1	2.4
Temperature atmosphere	59.0	10.0	36.0
Temperature engine room	86.0	68.0	80.0
Temperature fuel oil	152.0	131.0	145.0
Temperature cooling water inlet	57.0	54.0	55.0
Temperature cooling water outlet	117.0	109.0	113.0
Temperature exhaust	470.0	460.0	463.0
High heat value of fuel	....	....	19,180
Low heat value of fuel	....	....	18,020
Beaumé gravity of fuel at 60° F.	....	....	24.9
Viscosity (Saybolt Furol) at 77° F.	....	....	53.5
Sulphur content	....	....	0.76
Flash point (Pensky-Martens)	....	....	....
Burning point	....	....	....
Fuel oil pounds per hour	1,509	1,458	1,492
Fuel oil pounds per i.h.p. hour	....	....	.328
Fuel oil pounds per b.h.p. hour	....	....	*.444
Speed, r.p.m.	95.5	93.1	94.6
I.H.P. of power cylinders	4,493	4,280	4,423
Mean indicated pressure	....	....	87.2
Mean effective pressure	....	....	64.5
I.H.P. of scavenging pumps	....	....	266.7
I.H.P. of air compressor	....	....	284.0
Brake horsepower	3,305	3,233	3,275
Mechanical efficiency	....	....	74.0
Thermal efficiency	....	....	....

*Corrected to 18,500 B.t.u.

LUBRICATING OIL DATA AND CONSUMPTION

Engine Parts	Brand of Oil	Drops Per Min.	Gals. 24 Hrs.	
Power cylinders	Navy mineral	38	20.64	Gallons consumed for all purposes ave. for 24 hours
Scavenging pumps	D.T.E. ex.-hy. "W."	26	.93	
Air compressor	D.T.E. heavy "X."	23	1.03	
Piston rods	Navy mineral	20	Included in cyl. lub. cons.	
Hand feed	D.T.E. ex.-hy. "W"	..	1.00	
Force feed	D.T.E. ex.-hy. "W."	..	3.40	27.0

Time of stops—Only stop made during test was on February 3, when engine was stopped 6 hours and 7 minutes, due to leaky and defective plug in end of No. 2 piston rod.

WEAR ON POWER CYLINDERS

Cylinders Numbered from Fly-wheel

Top Cylinders	No. 1	No. 2	No. 3	No. 4
Maximum	.00875	.00575	.00900	.00900
Minimum	.00200	.00000	.00137	.00175
Average	.00375	.00275	.00447	.00400
Bot. Cylinders				
Maximum	.00825	.00525	.00825	.00750
Minimum	.00200	.00100	.00225	.00200
Average	.00340	.00175	.00395	.00375

BORE SMALLER AT SOME POINTS

Top Cylinders	No. 1	No. 2	No. 3	No. 4
Maximum	.0010	.0010	.0000	.0000
Minimum	.0000	.0000	.0000	.0000
Average	.0005	.0005	.0000	.0000
Bot. Cylinders				
Maximum	.0020	.0030	.0000	.0030
Minimum	.0000	.0000	.0000	.0000
Average	.0010	.0015	.0000	.0015

Liners were measured at six equally divided points of the piston ring travel. Four radial measurements were taken at each point. The average wear represents the mean of 24 measurements.

WEAR ON PISTON RODS

Rod	No. 1	No. 2	No. 3	No. 4
Maximum	.0023	.0010	.0008	.0004
Minimum	.0000	.0000	.0000	.0000
Average	.0001	.0005	.0003	.0002

Rods were measured at 5-inch spacings. Two radial measurements were taken at each point. The average wear represents the mean of 28 measurements.

WEAR ON MAIN BEARINGS

Bearing	No.1	No. 2	No. 3	No. 4	No. 5	No. 6
Average	.0008	.0005	.0005	.0005	.002	.001

Bearing shells were measured for thickness at bottom only.

PART LOAD TESTS

Tests Feb. 12 and 13, 1927	110% Load	75% Load	50% Load	25% Load	Astern 100% Load
Duration	6 Hours	2 Hours	2 Hours	2 Hours	1 Hour
Barometer	....	....	....	....	....
Pressure, injection air	1,120	855	800	718	1,080
Pressure, jacket cooling water	33.5	38.5	31.0	32.0	32.0
Pressure, piston cooling water	38.6	35.5	35.5	34.0	38.0
Pressure, lubricating oil	27.0	27.0	27.0	26.0	31.0
Pressure, scavenging air	2.6	1.9	1.6	1.5	1.4
Temperature atmosphere	39.0	39.0	37.0	34.0	35.0
Temperature engine room	72.0	72.0	70.0	65.0	64.0
Temperature fuel oil	150.0	150.0	125.0	125.0	110.0
Temperature cooling water inlet	54.0	55.0	55.0	55.0	55.0
Temperature cooling water outlet	119.0	118.0	110.0	104.0	115.0
Temperature exhaust	492.0	390.0	300.0	225.0	435.0
High heat value of fuel	19,180.0	19,180.0	19,180.0	19,180.0	19,180.0
Low heat value of fuel*	18,020.0	18,020.0	18,020.0	18,020.0	18,020.0
Beaumé gravity of fuel	24.9	24.9	24.9	24.9	24.9
Viscosity (Saybolt Furol) at 77° F.	53.5	53.5	53.5	53.5	53.5
Sulphur content	0.7	0.7	0.7	0.7	0.7
Flash point	.....	.....	.....	.....	.....
Burning point	.....	.....	.....	.....	.....
Fuel oil lbs. per hour	1,613.5	1,087.0	786.5	476.5	1,355.0
Fuel oil lbs. per i.h.p. hour	0.342	0.347	0.332	0.313	0.319
Fuel oil lbs. per b.h.p. hour*	0.444	0.442	0.483	0.535	0.451
Speed r.p.m.	93.67	84.70	75.70	60.20	88.0
I.H.P. of power cylinders	4,713.0	3,322.0	2,368.0	1,522.0	4,254.0
Mean indicated pressure	93.8	73.3	58.3	47.1	85.2
Mean effective pressure	70.4	52.9	39.1	28.9	58.7
I.H.P. of scavenging pumps	252.6	182.4	64.9	40.7	192.4
I.H.P. of air compresser	296.0	217.3	206.6	165.1	287.8
Brake horsepower	3,539.0	2,395.0	1,586.0	868.0	2,930.0
Mechanical efficiency	75.1	72.1	67.0	57.0	68.9
Thermal efficiency	.....	.....	.....	.....	.....

*Corrected to 18,500 B.t.u.

The 10 percent overload at 5 percent over-speed had to be discontinued on account of running into critical at this speed. Apart from the recorded stop the engine operated very well, both during the 30-day test and all part load tests. Pressures and temperatures ran uniform, and the exhaust was at all times clear. After completion of all tests the engine was dismantled for inspection, and found in excellent condition.

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Handling Bunker and Cargo Oil by Aqua Methods

Advantageous features of the aqua system and principles upon which it operates and method of control

By Wm. Reed-Hill*

NOT only the transportation of large quantities of gasoline, but the entire question of the stowage, handling, and transportation of all the liquid fuels, can be said to cause much worry to those interested, at any part of the processes.

In an illustrated article by Lieut. M. S. Serat, Jr., C.C., U. S. N., on Gasoline Cargo in the August issue of MARINE ENGINEERING AND SHIPPING AGE, two sources of origin of the problem (for gasoline) are chosen as major in influence:

1. Corrosive action on iron and steel;
2. The danger of fire and explosion.

Nothing so definite in application has been published recently on the hydraulic handling of a fuel, as Lieut. Serat's article. His emphasis on the dangers of carrying fuel in small cases could not have been more to the point. Large capacity should be provided and such hydraulic service as would preclude the possibility of free surface at any time while the system holds fuel. The exception to this is when, having stripped a tank, water is cleared out by suction for the purpose of cleaning. As, under proper operation, only a minute quantity of fuel remains in the shape of fluid globules, the cleaning process is rapid and certain.

Tanks are, therefore, while in service, continuously full or empty and clean.

KEY TO A GOOD HYDRAULIC INSTALLATION

The key to a good hydraulic installation is in the control which keeps air out of the tank at all times while at the same time providing the activating agent in the processes of service.

All functions of such a service should, to the furthest degree possible, be independent of the human factor. All functions of a complete system should register before the operator; contraction or expansion should be compensated for automatically. Fueling should stop, without intervention of the operator being necessary.

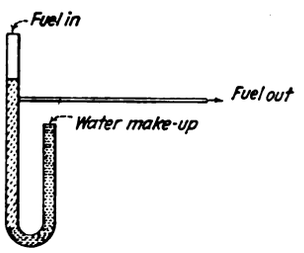

Fig. 1

The design of the system must provide easy operation with the minimum number of movements required for a given process, such as fueling, feeding, transfer or delivery overside. The design should provide for two or more of these functions simultaneously; and such processes should be controlled by one man at his central station. In other processes directly related to the service of fuel, except actual tank cleaning, one helper occasionally should be the only extra required.

In the average inquiry, we find other reasons than the corrosive action on iron and steel or the danger of fire and explosion leading to the effort to improve the conditions surrounding the handling of all liquid fuels.

One of the most important matters is the effect of free surface on G. M. Where the owners of a large vessel have recently been under the necessity of doing something to counteract the effect of free surface on the stability, an extraordinary weight of concrete ballast was found to provide one solution of the problem. A more profitable way would be to eliminate free surface altogether. The carrying of concrete ballast would not eliminate such troubles as broken suction; water in the fuel; dirt, clogged lines; delays in dangerous situations; to say nothing of the danger of fire and explosion.

The fuel on this vessel is pumped as usual from the bottom of the tank, where the worst of the fuel is found, stratified by stowage in the presence of air. If this fuel were carried as much for ballast as for any other reason, it must be handled by suction, as now designed. By use of aqua methods, delivery would be from the top of the tanks.

Even heavy oil produces such an explosive gas that operators avoid with care the taking of any chance with the tanks. Aqua methods take into consideration the nature of the gases resulting from the continuous evaporation of lighter fractions and the small ratio to air necessary to cause explosion; and, by proper control, retain such fuel without free surface.

Aqua Oil Service, Inc., makes use of ten natural laws by virtue of which the fuel tends to move in the system and it also makes use of seven mechanical devices for the purpose of control.

It is well understood that fuel may be retained in a U-tube or pipe, and withdrawn therefrom without difficulty under conditions illustrated below.

If, now, a tank be arranged on this tube as shown in Fig. 2, the difference is in the quantity of fuel that may be contained.

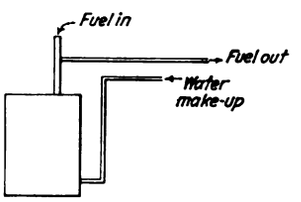

Fig. 2

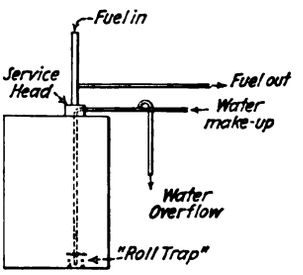

Fig. 3

If, in addition, Fig. 2 be modified by a simple readjustment of the piping and the introduction of a service head at the tank top and a "roll trap" at the foot of the water leg a skeleton Aqua System as shown in Fig. 3 results.

This is further modified by the use of the mechanical devices above noted to permit any service on any number of tanks. These devices are arranged to bring control into the hands of one operator at a central station.

NATURAL LAWS UTILIZED IN AQUA SYSTEM

Referring to fuels or other immiscible volatiles that float and flow (or can be made to) the natural laws above referred to are as follows:

1. Fuels, by nature, and other immiscible volatiles, by definition, do not mix with water in a container that is hard full.

* Maritime division, Aqua Oil Service, Inc., 2 Lafayette street, New York.

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2. In a stowage system for immiscible volatiles, including fuels, air is a cause of trouble and possible disaster. Its presence causes volatilization, stratification of fuel, evaporation, the development of sludge, emulsification of fuel. It assists oxidation and the deposit of hardened material on the structure and generally increases hazard and expense.

The forced use of the poorest fuel while the best is evaporating, broken suction, delays in serious situations are definitely due to the bad practice of handling oils like water in the presence of air, merely because oils are fluid.

The presence of air in a container means free surface and impaired stability.

The presence of air admitted through vents is a source of displacement of dangerous gases and is the one factor that generally necessitates expensive apparatus that could be avoided.

3. Fluids will flow when the outlet is below a fixed head.

4. In a U-tube, or an Aqua Service modification of it, the balancing of the fluids results in the aqua plane (the plane of the bottom of the fuel) rising in a definite relation to the dropping of the head. The ratio depends upon the specific gravity of the fluids in the system.

5. Disturbing the balance of the system results in surge.

6. When the head has dropped to the bottom of the fuel outlet, not only is there no further flow but the ratio above noted prevents any delivery of water.

7. In a hard tank the aqua plane is a definite level surface without relation to the angle at which a tank may be placed by rolling.

8. In a hard tank there is no opportunity for water particles to rise above or for fuel particles to drop below the aqua plane.

9. In a hard tank which may be subject to movement, as in rolling, etc., provision must be made to control displacement at critical periods in service.

10. The introduction of air, at any period of service, within such tank is evidence of fault of design that may at some step of service prevent operation or cause disaster.

The usual devices employed to effect control come under the following heads or types and are used only when required by the conditions affecting the system: Service heads, instead tubes, roll traps, gaging devices, oil control manifolds, main control unit, standard auxiliaries.

In some types of systems all are required; in others some may be omitted.

The diagrams show service heads on all tanks. Their purpose is local control and the affording of access to the tanks.

DEVICES EMPLOYED

Instead tubes are devices, in several forms, to take advantage of the possibility to transform an inner bottom tank, in effect, into a deep tank to secure control. Its height and shape depend on the information as to the expected degree of rolling. These tubes are large enough to permit access to the tanks and carry the service heads at the top.

Roll traps at the foot of the water legs are explained by their name. They are so devised that during rolling no fuel may be admitted to the water leg and thence overboard.

Gaging devices vary with the type of installation. They vary widely as to principle of operation. The cost of the cheapest device is less than $10. It is used for light freely flowing fluids and is read like a thermometer, which reading is corrected from data on specific gravities of the fuel and the water being used. With this necessary information the reading may be taken directly on a scale. In the simplest cases such a device may be made to serve any number of tanks, by taking readings successively. This type is based on simple data of balance.

Other devices include the well know Pneumercator instruments which need no description.

The oil control manifold is a specially designed unit, steam heated when required, connecting directly with each tank's service head and with lines for intake and discharge.

THE MAIN CONTROL UNIT

The main control unit, marked control manifold on the diagram is a battery of lever operated, three-port, double seated valves to control the several functions of the systems. By operating the proper levers of this unit water is admitted to follow up the fuel to keep the tanks hard full and gas free. It transmits water line pressure under the fuel in pressure tanks where such tanks are used to relieve the main tank tops. It permits expansion by allowing water to go overboard; as well as automatic make-up in case of contraction. It is the chief and essential unit of the group.

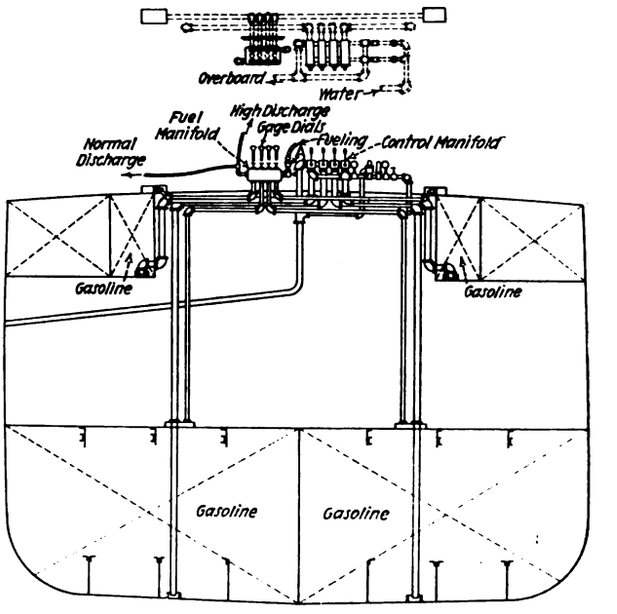

Fig. 4.—Section to show diagrammatically the simplicity of a complete aqua-serviced system of gasoline stowage and handling. Devices not detailed.

This illustration shows the positions of the piping and control manifolds and gages, and the service heads of the tanks. From such a system, gasoline can be delivered, at any speed, to any expected height, as to an airplane on the flying-off deck of a high vessel. No additional strain can be put on the main tanks beyond that allowed for ordinary service of fuel for the vessel's own uses, or overside. No gravity tanks are needed.

INSTRUCTIONS FOR OPERATION

Operation: Fueling, discharge, transfer, stripping, emptying.

Fueling: Connect hose at A and take fuel as usual at any speed, opening valve or valves at fuel manifold as desired. Fueling ceases automatically when tanks are filled. Close valves.

Discharge: Open valve in fuel manifold to operate from desired tank. For high delivery, open either end valve. For ordinary use, open either of the inner valves in manifold.

Fuel manifold valve being open, pull corresponding control lever.

Note: No extra pressure on lower tanks under any conditions. When desired quantity has been withdrawn return lever to standard position and close valve in fuel manifold.

Transfer: Note.—Lower tanks are for stowage and general use. Upper tanks are for taking greater pressure for high delivery.

If upper tank is exhausted on either side: return lever to standard position, pull opposite end lever, open fuel manifold valve to opposite tank and close valve of exhausted line.

To replenish exhausted tank open appropriate valves in manifold for transfer and pull stowage tank lever for discharge. When process is complete return lever and close valves.

Stripping Tanks: Open appropriate valves in fuel manifold and pull lever for tank to be stripped. Set open the remote control valve of line being stripped. After suitable time close all valves.

Tank is now stripped ready for quick cleaning in briefest possible time.

Emptying: A cross connecting system under the control valves permits application of suction on water leg of tank to be emptied. Proceed as usual.

It is possible to apply cleaning process at the same time so that when tank is empty it is also clean.

Its type and form depend upon conditions under which it is to be used.

Standard auxiliaries include the usual valves and parts and are used to a minimum number. It is not necessary to exclude additional line valves but such other valves are not essential to the functioning of the systems.

Much time and money has been spent on making these details as simple as possible and it should be understood that the essential parts only are used in the various types of systems. This allows the omission of much material in the system handling fuels of the lighter grades.

There are practicable methods to make tank tops oil-

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tight and capable of standing any pressure that a properly designed hydraulic system could require. Special flats need not generally be required.

DESIGN AND LOCATION OF TANKS

One word might be admitted on the subject of the design and location of tanks in a vessel. There can be all the difference imaginable between logginess and erratic behavior and reduced speed in one type of design where suction systems are combined with poor tank arrangement, and easy, smooth behavior with increased speed in another if designed for aqua service.

Sounding should be unnecessary in any well designed hydraulic system. There are several good methods in use to determine with sufficient accuracy the contents of either large or small tanks.

Gravity tanks should never be included in hydraulic systems. Besides being unnecessary these reintroduce the hazard that could otherwise be avoided. They are unnecessary for high delivery, as also are pumps, in the case of the lighter fuels. Against pipe line resistance, booster pumps are sometimes included; section pumps can be avoided.

No fear of over much pressure on bulkheads or tank tops need be entertained where high delivery is required. A simple automatic device is available, which can serve any but very heavy fuel to any height up to that of an airplane on a flying-off deck. As to the last named objective, it is possible to service such a plane at such a height without any spillage in a few minutes, with the operator at his station and a helper at the plane.

Unless the behavior of fluids in balanced systems is thoroughly understood a designer is apt to introduce unnecessary material or opposing processes and admit air to the tank, bringing back hazard and possible expense that he sought to avoid.

A very interesting type of aqua-serviced harbor delivery boat has been designed for use in the protected waters of rivers, sounds and harbors. Everything about this little cargo-carrier is contrived to reduce initial cost and operating expense, and to eliminate positively every trouble heretofore experienced in this type of fuel transportation and delivery. Designed by a well known naval architect to take full advantage of hydraulic methods, it should ultimately supplant the dangerous and clumsy expense-breeding type now seen in any harbor.

Why Welding Pays

AS difficulty has frequently been experienced in obtaining tight joints in riveted condenser shells, permission was secured to metal arc weld the one for Hull No. 317 under construction at the yards of the Newport News Shipbuilding and Dry Dock Company, Newport News, Va., according to a statement in the *Shipyard Bulletin* published by this company.

Some trouble was encountered in its construction but the results obtained so clearly indicated the superiority of welded over riveted construction for this class of work, that permission was also obtained to weld the condenser shell for Hull No. 319. In both of these cases, the shells were designed so as to obtain the maximum savings in cost and weight and to employ joints suitable for welding.

Similar cast iron and riveted condenser shells having been previously constructed for Hulls No. 280 and 287 respectively, it was possible to obtain an interesting comparison of costs and weights between cast iron, riveted and welded condenser shells.

Comparing the cast condenser shell (pattern included) with the welded shell for Hull No. 317 it was found that there was a saving of $847.00 in labor, material and overhead and a saving of $200.00 over the riveted shell for Hull No. 287.

In the construction of the second welded shell, the welding cost was actually reduced more than 50 percent, and should the heads and water chests of these condensers have been also constructed of welded steel instead of cast iron, it would have been possible to have shown even greater saving in cost. The saving in weight of the welded shell for Hull No. 317 over the cast shell was 50 percent and over the riveted shell 10 percent. As far as known, these are the first two completely welded condenser shells constructed to date.

The Specifications of the Bureau of Engineering of the Navy Department permit completely welded condenser shells.

President Coolidge Shows Interest in Proposal that Railroads Operate Ships

WASHINGTON, D. C.

THE man at the White House who talks to the newspaper correspondents for President Coolidge, but who is not supposed to be directly quoted, was asked by the newspaper men on September 13, on his return from a vacation at Rapid City, to comment on the suggestion made by Edward N. Hurley, formerly chairman of the Shipping Board, that it would be desirable for railways to engage in the ownership and operation of ships in foreign traffic.

It was reported that he displayed considerable interest in the suggestion, especially as one coming from Mr. Hurley, and thought that the efforts to develop an American merchant marine might be considerably stimulated if railroads owned ships and were therefore interested in seeing that more of the foreign commerce of the country were shipped in American flag vessels. He thought, however, that the subject would require careful consideration and was not prepared to discuss it very definitely, but he indicated that one of the obstacles to the building up of a merchant marine is the indifference of shippers and exporters and importers in failing to insist that their shipments be transported in American ships and also indifference on the part of railroads that have traffic relations with foreign lines and agencies.

The discussion started in relation to amendatory legislation to permit railroads to own steamship lines and the President was represented as believing that it would be well to make a comparison of conditions before the passage of the Panama canal act and those afterward, but it was suggested that the prohibition in the Panama Canal act is against railroads owning ships with which their rail lines might compete. Bills have been introduced in Congress on several occasions in connection with proposed marine legislation to amend Section 9 of the Panama canal act to make it clear that it shall not apply to the ownership of ships in foreign trade.

CURRENT AMERICAN SHIPBUILDING.—On September 1, American shipyards were building or under contract to build for private shipowners 193 steel vessels of 192,054 gross tons compared with 196 steel vessels of 200,105 gross tons on August 1, according to the Bureau of Navigation, Department of Commerce. There were 51 wood vessels of 23,544 gross tons building or under contract to build for private shipowners during the same period compared with 43 wood vessels at 18,649 gross tons on August 1.

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A Study of Screw Propeller Performance

The influence of small changes in underwater lines of ships' after bodies on the efficiency of propulsion

By Rear Admiral C. W. Dyson, U. S. N., Retired

IN the designing of screw propellers and in making an estimate of their prospective performances, a knowledge of the effect of the underwater lines of the after bodies of ships upon wake and upon the propulsive efficiency is necessary in order to insure a close approximation of the estimated performances to the actual performances of the propellers.

Hulls generally, according to the character of the submerged after body lines, may be divided into three types, 1, 2 and 3. One type fades into the next so that there is a zone between types where, unless experience is at hand to guide, it becomes problematical as to which type the hull belongs or whether it is a compromise between types.

Two such vessels have recently come to hand, the after bodies being very nearly alike, yet the first vessel, which shall be denoted by *A*, is a full type 1 hull while the second vessel, *B*, is evidently on the dividing line between types 1 and 2. *A* has the loss factor of a single screw type 1 ship, while *B* has that corresponding to a type 2 ship. Both vessels produce cavitation of the propellers at the type 1 limits.

The dimensions of the ships and the characteristics of the after bodies affecting the propeller performances are as follows:

	A	B
L. B. P.	427 feet	415 feet
B	57.17 feet	56 feet
H	23.25 feet	22.85 feet
Height of S. L. body = H'	21.25 feet	21.25 feet
B. C.	0.651	0.666
Coef. M. S.	0.978	0.978
H' ÷ B	0.372	0.379
Type	1	Between 2 and 1
B ÷ L. B. P.	0.134	0.137
H ÷ B	0.407	0.408
Slip B. C. = S. B. C.	0.668	0.668
L. A. B.	170.8	166
2 L. A. B. ÷ H'	16.08	15.62
S	0.0675	0.086
Loss B. C. = K. B. C.	0.7	0.715
Loss Factor = K	1.35	1.105

Attention is called to the great difference in the loss factors as this difference has a vital effect upon propeller performance, so far as propulsive efficiency is concerned.

Curves of displacement and model tank curves of effective horsepower were among the data supplied, and from them has been constructed Fig. 1.

The designer of the lines of *A*, in all probability, upon seeing the results shown by Fig. 1, would exclaim: "I am the modern Jack Horner. I have stuck my thumb into the pie of ship design and have pulled out a plum." He would be correct but he would find later that the plum was a very sour one. He would learn that the hull which is the easier to tow is not necessarily the easier to drive.

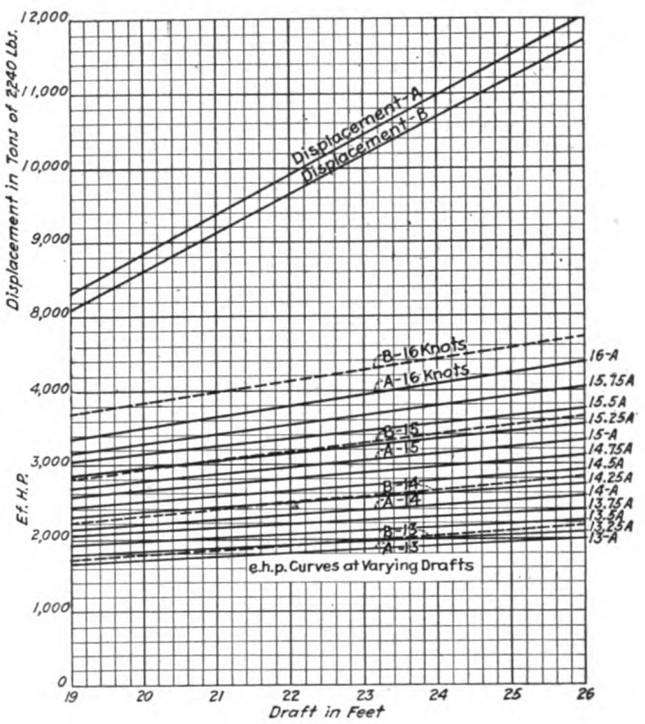

Fig. 1

Turn, now, from the hulls to the screw propellers.

Screw Propellers

Ship *A* has had two propellers fitted to her in her career up to date, while ship *B* has had but one propeller. The characteristics of these propellers and their basic conditions are as follows:

	Ship A			Ship B
	1st Prop.		2d. Prop.	
Number of propellers	1		1	1
Number of blades	4		4	4
Shape of blades	Bulbous		Fan	Standard Oval
	Tip	Full		
Basic P. A. / D. A.	0.386	0.3375	0.27	0.279
Total basic P. A. / D. A.	0.515	0.450	0.36	0.37
Basic diameter	18 feet		19.17 feet	18 feet
Actual diameter	18 feet		18 feet	18 feet
Pitch	22.5 feet		21.04 feet	22.5 feet
Basic tip speed	8,250	7,400	6,230	6,400
Basic apparent slip	0.0675		0.0675	0.086
1—basic apparent slip	0.9325		0.9325	0.914
Basic speed	30.21	27.09	20.22	22.97
Basic shaft thrust	5.23	4.15	2.8	2.96
Basic shaft horsepower	22,036	15,685	8,935	9,787
Basic propeller coefficient	0.592	0.638	0.695	0.693
Basic effective H. P.	13,045	10,007	6,210	6,783

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Reported and Estimated Performances

The owners of the vessels furnished tabular records of six round voyages for *A* with No. 1 propeller, eleven with No. 2 propeller, and ten for *B*.

These tables, among other data, gave the number of the voyage, the average speeds of the ship over the bottom, the average revolutions per minute of the propellers, the average shaft horsepowers, the average fuel per hour per shaft horsepower and the average drafts of the vessel in feet and inches.

The homeward halves of the voyages were partly in the gulf stream, full advantage being taken of the helping hand of the current, while on the outward halves the gulf stream was dodged as much as possible and aid taken from southerly and westerly currents.

It must be borne in mind that the quantities, speeds over the bottom, represent speeds through the water ± effect of currents, ± effects of wind, sea and condition of ship's bottom; while the noted shaft horsepowers are those due to tank effective horsepowers, ± effects of wind, sea and condition of ship's bottom.

Curves of Estimated Shaft Horsepowers and Revolutions at Different Speeds and Drafts of Ship

It must also be borne in mind that in making these estimated curves of performance at the different speeds and drafts of ship, the effective horsepower curves as shown in Fig. 1 are used and no allowance for the effect of currents, wind, sea and condition of bottom of ship are taken into account. The estimated powers plotted depend upon the effective horsepowers and the power-loss factor only, while the estimated revolutions plotted depend upon the speed of the ship through the water at the various drafts and effective horsepowers given by Fig. 1, upon the estimated shaft horsepowers and upon the basic slips.

There are no complications encountered in preparing the estimates of performances of the No. 2 propeller of *A* nor of those for the propeller of *B*, as they are both entirely free from cavitation.

In the preparation of the estimated curves for these two vessels constant basic slips of 0.0675 and 0.086, as taken from the hull lines, have been used. As a matter of fact the basic slips are not constant but vary with the speed as the trim of the ship changes due to change of speed and as the position of the crest of the ship's wave in relation to the ship's propeller changes. These changes are probably considerably augmented in cavitation over those occurring when no cavitation exists.

These differences between the actual basic slip and constant basic slip used in preparing the curves produce errors in the estimates of shaft horsepower and revolutions. When the actual is less than the used basic slip, the estimates of speed through the water and of shaft horsepower will be lower than the actual speeds and powers and *vice versa*.

In the cases of new vessels, the changes occurring in the basic slip values with variation of speeds and trim must be neglected and the small errors produced by using a constant basic slip accepted.

Where old ships are concerned, these same errors must be accepted where no power, revolutions, speed data obtained from trials over measured courses in deep water are available. When the propellers are out of cavitation or when the basic slips are in excess of 0.1325 when the vessel is of type 1 o. 2, or less than 0.1325 when the type is 3, and the propellers are in cavitation due to excess thrusts, and such curves of data are available, the actual basic slips at the various speeds can easily be computed.

Should the vessel be of type 1 or 2 with basic slips less than 0.1325, or type 3 with basic slip greater than 0.1325, no speed data are necessary but, provided a curve of shaft horsepower and revolutions, at known draft of ship, obtained from trials in deep water, and with good weather and sea conditions, is available the values of the basic slips at the different speeds through the water and these speeds themselves can be computed without difficulty.

Such a vessel, and of type 1, is ship *A*. Its first propeller is in cavitation at all speeds from 13 to 16 knots. There is available for it a curve of shaft horsepower—revolutions taken in deep water and good conditions at 22 feet-6 inches draft of vessel. This curve is shown in Fig. 2.

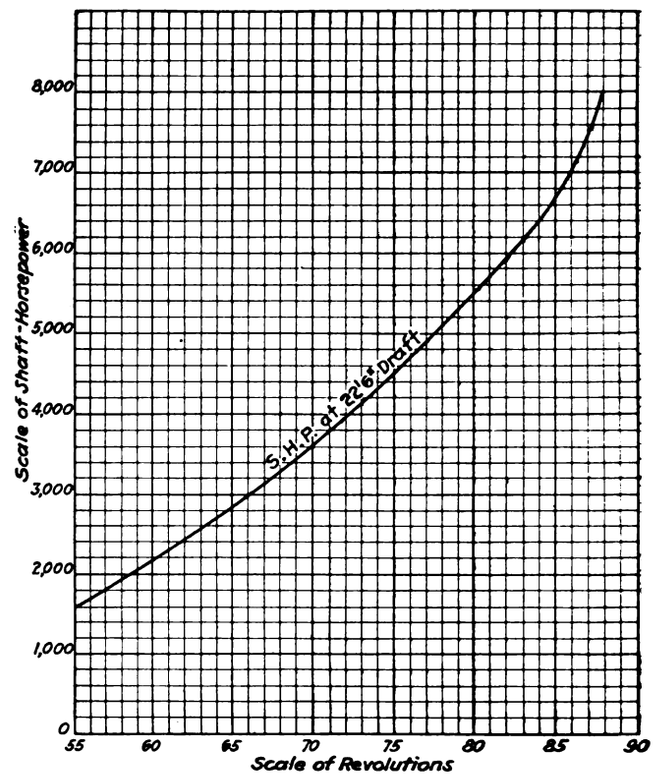

Fig. 2.—Ship A at 22 feet 6 inches draft, first propeller

Vessels similar to *A* have a peculiarity upon entering cavitation which greatly assists in the solution of such a problem as the present one. When entering cavitation with the propeller absorbing any given power, the revolutions immediately increase slightly. These new revolutions, however, remain constant so long as the power remains constant until the actual speed of the ship through the water equals 0.91 of the speed at entering cavitation. At this point a reduction factor enters; this factor decreasing in value as the ratio between the two speeds decreases until finally it reaches a minimum.

The problem of No. 1 propeller is complicated by the blade projected form, which is bulbous. While the estimate of power for any given net resistance is computed by taking into account both the standard projected area form due to the tip width of the blade and the actual projected area ratio of the propeller, the revolutions upon entering cavitation due to excess thrusts depend upon the tip conditions only.

Taking the values of shaft horsepower for 70, 75, 80, 85 and 86.68 revolutions, there were determined, from the tip basic condition of the propeller, the gross load fractions for these powers. Assuming basic slip values of 0.05, 0.07 and 0.09, and taking the values of the speed fraction on the cavitation limit curves of these slips for the different gross load fractions, the estimate of revolutions for each gross

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load and assumed basic slip can be determined, as also the speed at which the propeller enters cavitation.

Plotting the revolutions and cavitating speeds on assumed basic slips as abscissas, the value of the basic slip giving the desired revolutions and the corresponding cavitating speed can be obtained.

This has been done for No. 1 propeller and the results plotted on Fig. 3. On this figure, curve (1) is the curve of

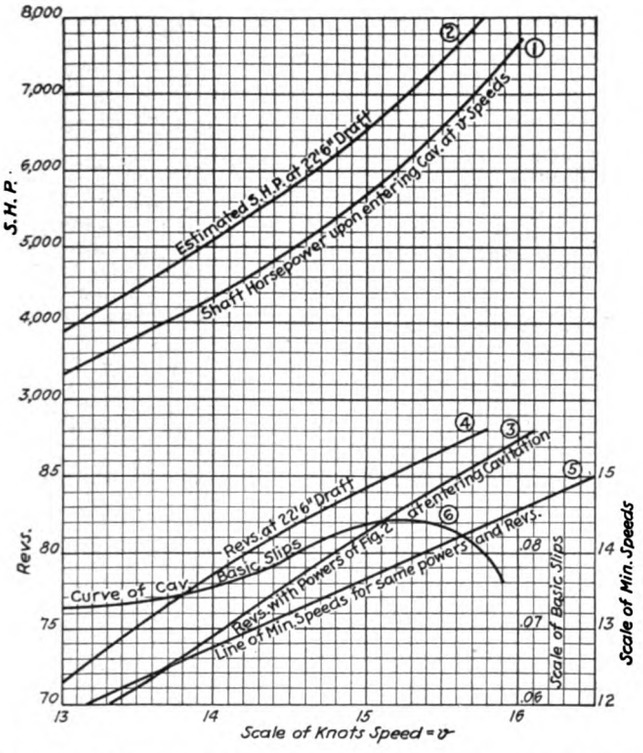
S.H.P.
Revs.
Estimated S.H.P. at 22'6" Draft
Shaft Horsepower upon entering Cav. at v-Speeds
Revs. at 22'6" Draft
Basic Slips
Curve of Cav.
Revs. with Powers of Fig. 2 at entering Cavitation
Line of Min. Speeds for Same powers and Revs.
Scale of Basic Slips
Scale of Min. Speeds
Scale of Knots Speed = v

Fig. 3.—Estimated speeds for power and revolutions of Fig. 2

shaft horsepower, (3) the curve of revolutions at the speeds given by the abscissa values. (6) is the curve of basic slips and (5) the line of speeds equal to 0.91 of v upon entering cavitation.

Attention is called to the fluctuating character of curve (6). The hollow of the ship's wave is evidently directly over the propeller at 15.25 knots speed while at 13 knots the crest of the wave has reached that position. This curve (6) is that which exists with deep water. As the water shallows a depth will be reached at which the wave length begins to shorten and its height to increase. As the shallowing of the water progresses, a depth dependent upon the dimensions of the ship will at last be encountered at which the crest of the wave, but a wave of considerably increased height, will be over the propeller at 15.25 knots. This will reduce the basic slip, reduce the revolutions and may take the propeller entirely out of cavitation, thus giving an unexpected great increase in the propulsive efficiency. To shallow the water still further will cause the wave crest gradually to shift away from its position of greatest advantage, thus causing a gradual decrease in the propulsive efficiency until, due to the greater height between crest of wave and hollow, the depth of water of the propeller becomes so reduced as to cause a very serious falling off in propulsive efficiency over that which can be obtained at the same speed in deep water.

Such a condition is encountered in a trial of this same vessel *A*, fitted with No. 1 propeller. A series of three runs were made over a course 11½ knots in length, from Five Fathom Bank Light Ship to Northeast End Light Ship. Two runs were made in one direction while the middle run was made in the opposite direction.

The results were:

Run No. 1....Speed 15.5	15.875	15.861
Run No. 2....Speed 16.25		
Run No. 3....Speed 15.444	15.847	

The shaft horsepower was 7,400.

The revolutions were 86.68.

The draft was 24 feet 4¼ inches, ship trimmed 12 inches by the stern.

An analysis of the performance tells that the basic slip has become 0.0754, that the propeller is just on the cavitating limit curve so that the revolutions have speeded up with no ensuing loss of power. The balance between *A* and *B* ships has been restored so that instead of the loss factor for *A* being 1.35 it is now 1.105, the same as that for *B*. This reduction in the power loss factor is undoubtedly due to the location of the crest of the following wave, nearly, if not exactly, over the propeller, and the forward velocity and consequent forward thrust of this wave on the stern of the ship and on the propeller. No such phenomenon is encountered in the deep water runs of the vessel.

The only other possible, though not probable, explanation of this phenomenon is that a mistake has been made

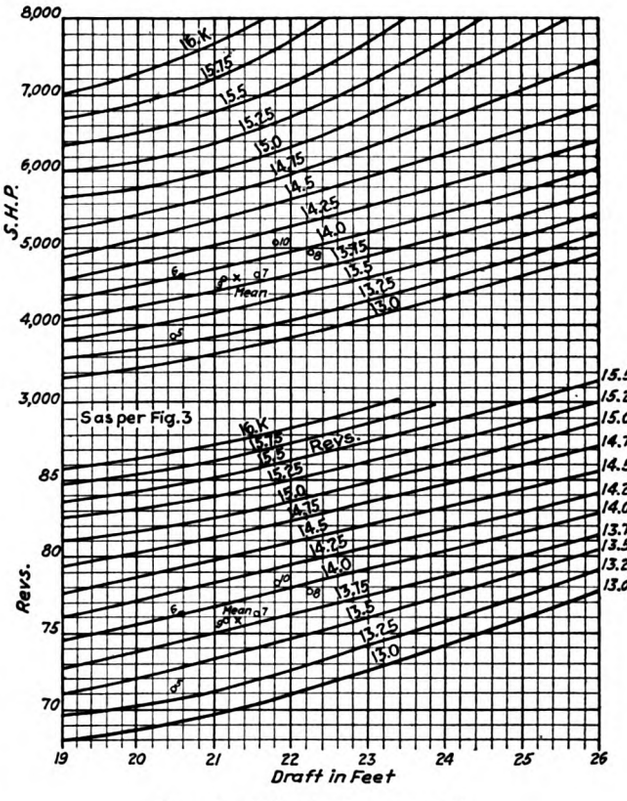

Fig. 4.—Ship A, first propeller

in the draft given and that instead of being 24 feet 4¼ inches, it was only 21 feet.

Returning to the problem, Fig. 2, as already stated, shows the curve of shaft horsepower—revolutions at 22 feet 6 inches draft. Taking the effective horsepowers from the curves of effective for 22 feet 6 inches draft, Fig. 1, an estimated curve of shaft horsepower for speeds from 13 to 15 knots is calculated and is then laid down on Fig. 3 as the curve marked (2). For equal powers with curve (1), the revolutions are equal as all of the speeds for curve (2) are greater than those of curve (5). The resulting curve of revolutions for 22 feet 6 inches draft is shown on Fig. 3, marked (4). In a similar manner curves of estimated

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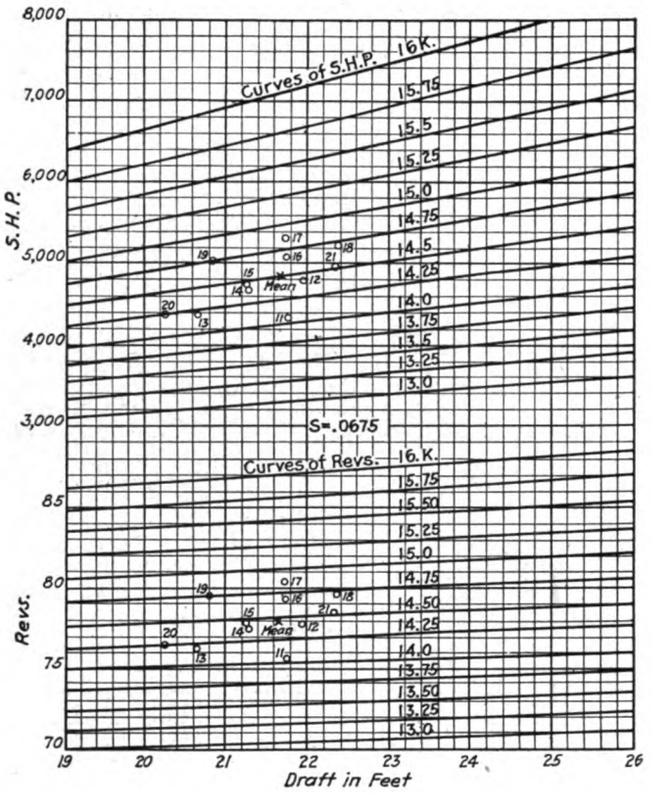

Fig. 5.—Ship A, second propeller

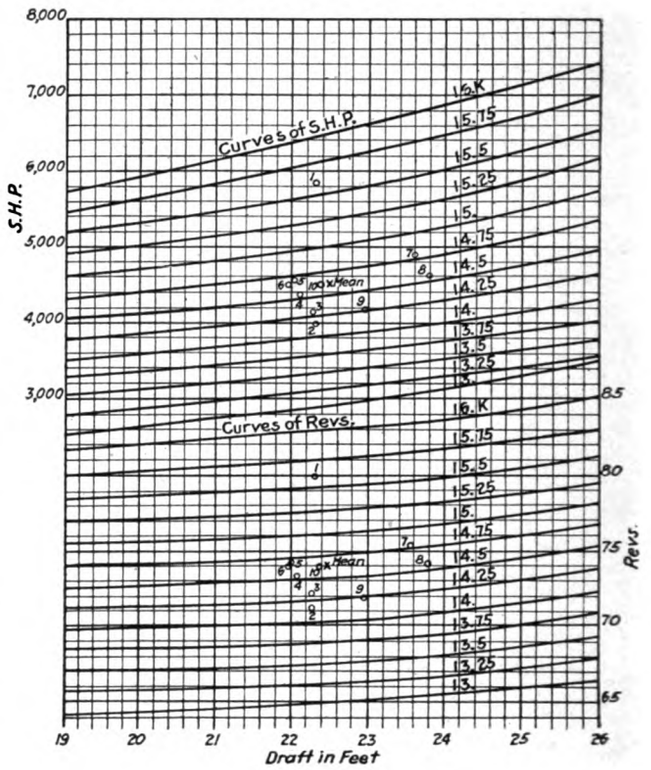

Fig. 6.—Ship B

shaft horsepowers and of revolutions can be obtained for other conditions of draft.

From these curves cross curves of shaft horsepower and of revolutions have been taken and are shown on Figs. 4, 5 and 6, the abscissas being drafts of ships in feet. Fig. 4 is for ship *A*, No. 1 propeller; Fig. 5 for ship *A*, No. 2 propeller; Fig. 6 for ship *B*. The curves are all laid down for speeds varying by quarter knots from 13 to 16 knots.

On these same figures, taking average revolutions and draft per voyage as the fixed quantities, are plotted the points for speeds over the water and for estimated shaft horsepowers, the points for each voyage being marked by circles while the points for the averages of the voyages are marked by X.

It may be asked whether ship *A* might not do better if fitted with the propeller of ship *B*. The answer is in the negative. The two figure out as nearly equal, with the second propeller of ship *A* having a slight advantage.

Complete voyage	Knots over bottom	Mean draft	Revolutions	Reported mean S.H.F.	Estimated mean S.H.P.	Estimated knots through water	Lbs. fuel per S.H.P. Rep. S.H.P.
			Ship A—First Propeller				
5	12.95	20′ 5½″	71.4	3,830	3,880	13.35	1.109
6	14.10	20′ 7⅛″	76.2	4,690	4,650	14.05	1.009
7	14.20	21′ 6¾″	76.2	4,685	4,685	13.85	0.957
8	14.25	22′ 2⅝″	77.65	4,955	4,950	13.92	0.961
9	14.05	21′ 2″	75.8	4,615	4,620	13.85	0.943
10	14.35	21′ 9⅝″	78.4	5,100	5,100	14.15	0.925
			Ship A—Second Propeller				
11	14.25	21′ 9⅛″	75.6	4 480	4,320	14.15	0.993
12	14.30	21′ 11⅝″	77.8	4,925	4,780	14.40	0.982
13	14.30	20′ 7⅝″	76.2	4,515	4,380	14.20	1.042
14	14.35	21′ 3½″	77.5	4,835	4,680	14.40	0.958
15	14.25	21′ 3¼″	77.75	4,865	4,750	14.42	0.989
16	14.45	21′ 9″	79.20	5,120	5,060	14.66	0.991
17	14.35	21′ 8⅝″	80.35	5,460	5,300	14.85	0.932
18	14.35	22′ 4⅜″	79.60	5,350	5,200	14.70	0.949
19	14.40	20′ 9½″	79.55	5,210	5,020	14.75	0.955
20	13.90	20′ 3″	76.50	4,540	4,390	14.25	1.008
21	14.50	22′ 3⅝″	78.40	5,050	4,970	14.50	0.961
			Ship B				
1	15.20	22′ 3½″	80.00	5,660	5,850	15.6	0.901
2	14.22	22′ 3¼″	71.20	4,150	4,000	14.15	0.882
3	14.18	22′ 3¼″	72.15	4,270	4,170	14.3	0.921
4	14.50	22′ 1″	73.40	4,375	4,380	14.55	0.894
5	14.36	22′ 0″	74.20	4,500	4,550	14.7	0.915
6	14.45	21′ 11½″	74.00	4,510	4,500	14.67	0.912
7	14.40	23′ 7″	75.45	4,575	4,900	14.77	0.988
8	14.30	23′ 9½″	74.15	4,525	4,600	14.56	0.923
9	13.95	22′ 11½″	72.00	4,330	4,180	14.25	0.918
10	14.10	22′ 4¼″	74.00	4,450	4,500	14.63	0.891
			Average				
A-1	13.98	21′ 3.6″	75.94	4,646	4,647	13.86	0.983
B	14.37	22′ 5⅜″	78.041	4,941	4,805	14.48	0.987
A-2	14.31	21′ 7⅝″	74.055	4,534.5	4,523	14.618	0.915

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The second propeller of *A* and that of *B* are practically as efficient as can be fitted to those vessels. No betterment sufficient to justify the expense can be expected from any change that might be made in them.

In the accompanying table are entered, Column 1, number of complete voyage; Column 2, average speed over the bottom; Column 3, average draft of ship; Column 4, average revolutions; Column 5, average torsion meter shaft horsepower; Column 6, estimated shaft horsepower for average revolutions and draft; Column 7, estimated speed of ship through the water for the estimated horsepower and average revolutions at the average draft; Column 8, average pounds of fuel oil per hour for average shaft horsepower.

Attention is called to Column 8. It would appear that if any great improvement is to be made in the performances of ship *A*, the condition of the machinery, particularly of the boilers, and the methods used in burning the oil should be carefully investigated.

It would be of great interest to have the models of these two vessels tried out self-propelled in the model tank. Would such tests show up the great difference produced by the small hull changes when reproduced on such a small scale?

Two New and Valuable Aids to the Navigator

By Robert G. Skerrett

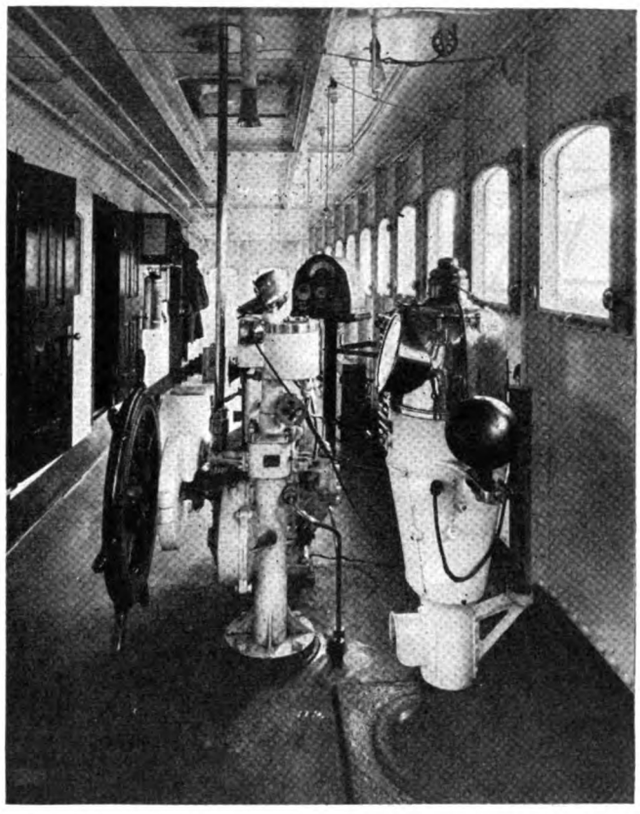
SAFER and surer navigating of ships is now possible, thanks to the perfecting of two independent but interrelated instruments. One of these instruments will enable the man at the wheel to keep more surely upon the set course; and the same instrument will serve as a positive and automatic check upon the familiar methods of dead reckoning. In other words, it will, in effect, not only trace the course the ship has followed but it will serve to indicate the position of the vessel at any time in relation to the set course. Because of this capacity of the apparatus, it is appropriately called the "path and position indicator."

The other and controlling unit of this combination of navigating instruments is a "magnetic master-compass" capable of operating electrically one or more repeater compasses without having its own magnetic sensitiveness impaired in the least degree. In the precision of its performance, this master compass is just as dependable as the best of master clocks that operate electrically a system of repeater clocks; and the new compass surrenders none of those characteristics or functions so essential in a navigator's compass.

The "path and position indicator" and the "magnetic master-compass" are the product of the inventive genius of Edward L. Holmes. The difficulty of keeping a ship on a set course when a quartering sea is causing her to yaw continually is well known. All too often, the captain, the officer of the watch, and the man at the wheel differ as to whether or not the ship has been brought back to the set course, even though she is heading aright according to the compass. During an interval of some hours, the cumulative effect of yawing and the uncertain work of the man at the wheel may carry the craft to one or the other side of the set course, though traveling parallel to it. It is this consequence of yawing and faulty steering that adds much to the navigator's problem of estimating a ship's position by dead reckoning when the sky is too obscured for astronomical observations. This cumulative error, under some conditions of wind and sea, may amount to 10, 15, and more miles in the course of a 24-hour run. True, this is not so serious a matter when the ship has plenty of sea room; but it may become a very serious matter when within soundings and when nearing a fog-bound coast. At all times, it represents a wasteful expenditure of time and fuel.

A path and position indicator and a magnetic master-compass that meet the practical requirements of navigation, have now been brought to the manufacturing stage by the Holmes Navigating Apparatus Company, 43 Cedar street, New York. They have been subjected to rigid tests, both ashore and afloat, and have been found capable of doing all that is claimed for them by their makers.

While the path and position indicator can be controlled



Path and position indicator, hooked up to a gyro compass, installed on board an American freighter

either by a gyro compass or by the magnetic master-compass, as has been established by long voyages at sea, still the instrument was originally conceived as a companion apparatus for the Holmes magnetic master-compass. For a broad understanding of the Holmes liquid compass, it will suffice now if we say that the movement of the compass needle, in a special electrolyte, alters or unbalances the resistance of two opposing electric circuits through which a weak alternating current flows.

To make this possible, the needle float carries four quadrilaterally disposed platinum electrodes—terminals, respectively, of insulated sections of the two opposed electric circuits; and on adjacent sides of the bowl are four segmental plate electrodes—also of platinum—so as not to be injured by the electrolyte. There is always a fluid-filled gap between each electrode on the magnet float and its neighboring electrode on the side of the bowl; and it is the interval between each pair of electrodes—varying according to the direction in which the magnet float moves—that determines the measure of resistance offered to the current as it flows through the opposing or opposite electric circuits.

Manifestly, any angular movement of the magnet float

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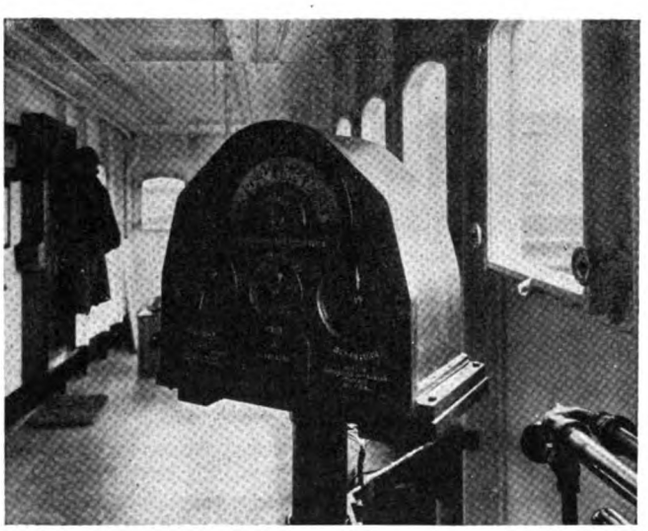
must upset the normal balance existing between the two circuits when the float is at rest; and this unbalancing is utilized to effect a sensitive relay, which, in its turn, controls a small reversible motor. The motor causes a follow-up ring—mounted above the compass bowl—to turn to the right or to the left so as to bring the markings on a phantom compass card in accord with those of the regular card in the bowl. As the follow-up ring is thus moved to right or left by the motor—until unison is effected between the two compass cards and the two circuits are again balanced—the ring travels over a succession of contacts by which electrical impulses are transmitted to one or more step-by-step motors that actuate the dial or dials of a corresponding number of repeater compasses. In this manner, the repeaters are made to register in harmony with the magnetic master-compass. Should the follow-up system be out of service for any reason, the magnetic standard compass—the heart of the system—would be left unimpaired to serve its intended purpose as the prime navigational aid.

The magnetic master-compass actuates a repeater compass card on the path and position indicator. And it is by this repeater card that the course is set from any point of departure. When that course is set, the hand on a dial immediately below the compass will point at zero. This hand carries a white star to make its movement more readily observable by the man at the wheel; and the shifting of this hand at once warns the steersman that he is to the right or to the left of the set course—the dial scale reading to three decimals of a mile. To bring the ship back on the set course—not parallel with it—the man at the wheel must steer the vessel so that the star hand shall be at zero and so that the hand above the instrument's

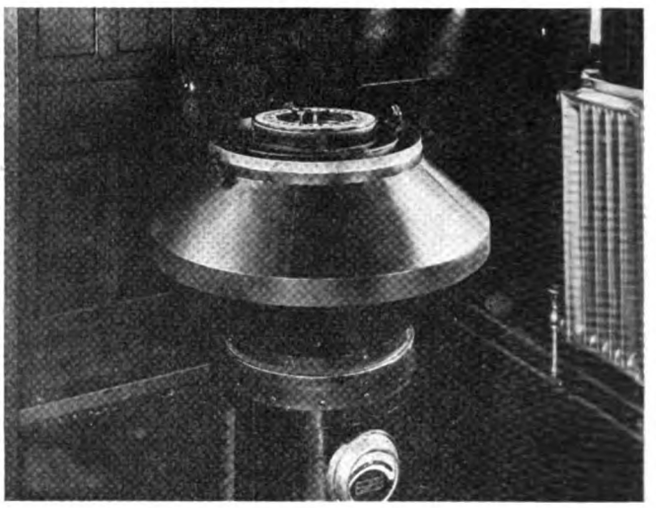


Close-up of path and position indicator

compass card shall be in line with the prescribed point. As can be seen, the path and position indicator does away with all guessing on the part of the steersman, and gives him a positive guide by which he can bring his ship quickly back upon the set course after her head has been swung to right or to left of that course by yawing or by careless steering.

Two other dials are provided on the front of the path and position indicator. One of these registers the distance made good in relation to the set course and the other registers the amount of departure, at any time, from that course. The readings are based upon a speed of 1 knot; and to make them applicable to a given ship it is necessary only to multiply them by the known speed of the craft as determined by her log or revolution counter. With the two sides of the triangle thus obtained, it is an easy matter to ascertain the ship's position so far as that position is the result of steering—a very fruitful source of error in computing a vessel's position by dead reckoning.

As should be readily understood, the path and position indicator is used as a steering instrument instead of the



Magnetic master compass, controlling a path and position indicator and a repeater compass

time-honored steering compass alone, and is placed in front of the man at the wheel. The magnetic master-compass, on the other hand, can be mounted wherever is most convenient for navigational purposes and where it will be farthest removed from local disturbing influences; and, when so situated, it can be used to control the compass dial of the path and position indicator, as well as the dials of any desired number of repeater compasses.

The Brinell Hardness Test As Applied to Marine Engines

By Arthur B. Butterworth*

IN the Brinell hardness test a hardened steel ball is pressed into the smooth surface of the metal so as to make an indentation of a size such as can be conveniently measured under the microscope. The spherical area of the indentation being calculated, and the pressure being known, the stress per unit of area when the ball comes to rest is calculated, and the hardness number obtained. Within certain limits, the value obtained is independent of the size of the ball and of the amount of pressure.

While it is not claimed that the Brinell test will determine in advance the wearing qualities of metal, this article will show how any person supervising repairs to a vessel can determine with the least expense and loss of time whether liners, piston rings, follower plates, etc., are within certain tolerances as to hardness. In other words the Brinell test should be used as a comparison test. The writer has had the opportunity of observing Brinell tests made on piston rings, new and old liners, etc., including those that have not given the best results, over a period of a year. The

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numbers ran from 116 to as high as 202, the average number found was 170 (these castings were made at various foundries). From these observations it is reasonable to expect good results with this test with small chances of any serious mistakes.

Quoting from one of the Bethlehem Steel Company's publications, "in soft grey iron castings the Brinell number will run from about 130 to around 175. The hard grey iron castings, which are machinable, will show Brinell numbers of from around 175 to about 250. The hardness represented by Brinell number 250 is about the limit of hardness for ordinary machine operation. Above this the casting is usually impossible to machine." Personally, I believe that a cylinder liner should be hard, not brittle, with a Brinell number around 200. The rings for this particular cylinder would be around 180, meaning that the rings would be softer than the liner in order to take up most of the wear. On a piston ring replacement for this particular cylinder a Brinell number as mentioned would be a requirement.

Under the present system, when a liner, piston follower, bull ring, etc., is installed in a cylinder at a shipyard, the castings must appear to be of good grade iron, free from blow holes, flaws, porous places, cold shuts, scabs or other imperfections affecting their strength or appearance. This, however, requires only a superficial and often slighted inspection. Castings in shipyards are not as a general rule made to specifications. Even if they were, there are other things besides the composition of the metal that would make them unfit for installation and use in certain parts of a marine engine. The rate at which cooling takes place affects the characteristics of the casting almost as much as its chemical properties. Assume, however, that after this kind of inspection the liner is installed. If, after the engine has been operated a short time, we find the liner is very soft and is wearing down considerably, every practical operating engineer knows the results that follow.

As the rings supplied to vessels according to the above requirements may be hard or soft and spongy, it cannot be expected that all the rings will give the best results. As an illustration: On one occasion when a set of intermediate piston rings was furnished vessel, we were instructed to be careful in hauling them from the shop to the vessel. We decided that if they were too tender to be hauled they certainly were not fit to be placed in a vessel's cylinder and upon arrival their fate was quickly decided. The shop ordered out another set (no Brinell number was taken) and upon completion these were installed in the cylinder. During a voyage, when the vessel had to compound, on account of high pressure cylinder trouble, and the load on the intermediate cylinder was increased, the rings cut the cylinder to such an extent as to make it necessary to renew the liner. The adoption of a Brinell number and its use on these particular rings would probably have prevented this trouble and expense.

It must be understood that to adopt Brinell hardness numbers for piston rings and the like, when the hardness of the liner is not known, is practically useless. To accomplish the best results it is recommended that when a new liner is installed the hardness number should be obtained, top and bottom, at four different positions. The liner could then be marked in a conspicuous place with the proper number. As far as we know there is no portable hardness testing machine on the market, but it is hoped that some farsighted manufacturer will see the opportunity for a light, compact, reliable, portable testing machine, for the purpose of determining the hardness of liners, etc., previously installed. When this is done a great deal of cylinder trouble will be avoided.

A new high pressure cylinder liner was installed July 23, 1923, on a vessel's triple expansion engine, the bore at that time being 18½ inches. The liner was re-bored on April 11, 1924, and again on January 13, 1925. The liner was finally removed on October 12, 1925, the bore at that time being 19½ inches. Six or more sets of piston rings were worn out in this time, the reason being the extreme softness of the liner, which had a Brinell number of 116. All of the worn particles of metal passed through the cylinders, valves and packing, clogging up the cylinder cocks, etc. Although it would be impossible to determine the cost of wear and tear on the engine in this particular case, nevertheless it is obvious that this expense could be very materially reduced if not entirely eliminated.

While it is commendable and economical to conserve scrap metal, nevertheless it should be remembered that scrap metal has been a contributing factor to the inferior grades of castings that are furnished in vessel replacements. Under no consideration nor at any price should inferior castings be used for cylinder liners, piston heads, piston rings, follower plates, etc. Repair yards do not take proper precautions in the mixture of iron castings and the result is that anything will go into the furnace. Repair yards are not fully to blame, vessel operators can eliminate this trouble entirely in demanding a better grade of castings and get the most for their money. Sooner or later somebody must work out the problem and in order to get good results both the representatives of the operators and the officials of the repair yard must cooperate. It is an injustice to both to expect a repair supervisor to look at a casting and judge whether it is up to standard or not. All of us attempt to do this because it is common practice and there are no better methods available.

When it is considered that thousands of dollars are expended annually for vessel repairs and replacement, it is remarkable how little attention is given to making sure that proper materials are being used. Of all the large operating companies I cannot recall any that specify the composition of the castings and follow them up with any kind of a test to see that they are up to specifications. This is probably the reason that we often hear the expression: "We cannot make as good grade of casting in this country as they do in Europe." Of course we can, if they are demanded and followed up with sufficient tests.

Two cylinder liners were replaced in a motor vessel's engine of American make. These liners had run 241,977 miles in 5 years. Test pieces were taken off the extreme ends of one liner. The Brinell number on top showed 170-174 and on the bottom end 179-183. The chemical analysis showed that these castings were of the ordinary grade used in steam engine cylinders. The writer is of the opinion that these liners should have been harder, especially for this class of engines. As Diesel engines are running steam a close race, it seems only logical to require exacting specifications and a hardness test for cylinder liners, pistons, rings, etc., on this class of vessels.

Take a typical automobile cylinder casting, analyzing silicon 2.660 percent, phosphorous 0.077 percent, sulphur 0.145 percent, manganese 0.600 percent, total carbon 3.020 percent, tensile strength 36,740 pounds per square inch, Brinell hardness 223 to 229. These castings machine readily, but it is very rare indeed to secure a casting such as this in marine repairs. One automobile company checked up a cylinder on one of its test cars after the car had run 45,000 miles. The wear in the cylinder was found to be less than five ten-thousandths of an inch. The reason was plain—the proper material was in the cylinder. Although the automobile industry is a comparatively young industry, we can profit by their methods and requirements in the use of metals. One of the greatest assets and advertisements of the American-built automobile today is the

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fact that nothing but the best material is used in the structural parts.

While the scope of this article and the data which it contains are limited, it is hoped that the article will bring out discussion that will eventually show from a dollar and cents point of view that material tests on vessel replacement work will pay.

The following compositions were selected principally for their hardness as shown by the Brinell numbers in the last column:

Silicon, Percent	Sulphur, Percent	Manganese, Percent	Phosphorus, Percent	Nickel, Percent	Chromium, Percent	Total Carbon	Comb. Carbon	Tr. S. Lbs.	T. S., Lbs.	Brinell No.
STEAM CYLINDER LINERS										
2.60	.065	.62	.310	.14	.21	3.436	.580	3,845	28,650	202
1.80	.100	.58	.450	.12	.17	3.326	.710	4,161	33,620	202
1.34	.086	.60	.110	.15	.16	3.436	.710	4,022	31,830	204
1.50	.085	.57	.114	.18	.38	3.292	.556	4,492	37,410	201
PISTON HEADS, RINGS, FOLLOWER PLATES (For Above)										
1.42	.107	.56	.876	.12	.28	3.680	.556	3,126	21,890	185
1.67	.103	.62	.402	.20	.35	3.708	.492	3,190	21,090	185
2.45	.071	.60	.106	.20	.19	3.436	.682	3,853	27,850	185
1.87	.125	.58	.800	.15	.15	3.572	.682	3,040	23,780	185
DIESEL ENGINE LINERS										
1.15	.083	.56	.140	.14	.32	3.108	.764	4,733	41,780	229
1.57	.112	.58	.414	.12	.16	2.970	.680	4,741	44,570	229
1.69	.102	.55	.720	.28	.23	3.272	.874	4,400	37,200	229
2.48	.100	.54	.438	.23	.18	3.064	.572	4,777	39,195	229
PISTONS AND RINGS FOR ABOVE										
2.35	.111	.57	.880	.10	.16	3.272	.736	3,642	31,040	217
1.12	.094	.56	.096	.14	.15	2.972	.736	4,550	41,780	217
1.04	.095	.59	.470	.30	.26	3.598	.880	3,990	37,880	217
1.60	.125	.57	.828	.20	.25	3.436	.710	3,785	27,060	217

Course in Naval Architecture to Be Given for Employees at Newport News Yard

A COURSE in naval architecture and marine engineering for employees of the Newport News Shipbuilding and Dry Dock Company, Newport News, Va., will open on Tuesday evening, October 4, according to an announcement in the *Shipyard Bulletin* issued by this company. Any employee of the company may enroll for the course provided he is seriously interested in the problems to be considered in the lectures and desires to obtain a general understanding of the subject.

The lectures will cover such a broad field that the method of treatment must necessarily be a popular one aimed to give a general grasp of the subjects on which the work of the shipyard is primarily based. An advance synopsis of each lecture will be issued a week prior to its scheduled delivery, giving an outline of the points and the matters to be considered with a list of references which the student may consult prior to the lecture, if he so desires. Reading on the subjects from books and magazines will be suggested by the lecturer.

The meetings will be held in Building No. 508 at the rear of the apprentice school on Tuesday evenings beginning at 7:30 o'clock and lasting about one hour. The list of subjects and speakers is as follows, the order of the lectures being subject to change:

1 H. L. Ferguson—Outline of course and object. Importance of proper calculations and design. Mistakes that have been made.
2 S. A. Vincent—Ship coefficients—Simpson's Rule—Calculations for displacement, and center of buoyancy.
3 S. A. Vincent—Calculation of trim, stability, inclining experiment, etc.
4 H. F. Norton—Ship forms for economical operation.
5 H. F. Norton—Elements and essentials of design with special reference to the scout cruisers. Hull.
6 J. F. Nichols—Elements and essentials of design with special reference to the scout cruisers. Propelling machinery and hull engineering.
7 G. C. Mason—Stress calculations in ship parts and fittings.
8 H. F. Norton—Main hull strength calculations.
9 H. T. Bent—Necessity for designing for efficient construction.
10 S. A. Vincent—Launching calculations—Lubricant—Draft of water—Crushing pressure, etc.
11 J. B. Woodward—Powering ships and model tank experiments.
12 C. F. Bailey—Types of machinery for various classes of vessels.
13 J. F. Nichols and N. Christiansen—Progressive and full power trials—Cruising radius—Water and oil consumption.
14 S. A. Vincent—Ordinance, gun fire control and other warship elements.
15 C. B. Coe—Steering gear and other deck machinery.
16 G. C. Mason—Rigging, cargo and boat handling gear.
17 E. W. Sniffen—Ventilation, plumbing and hull piping arrangements.
18 J. W. Daughtrey—Arrangement of machinery and its piping.
19 H. C. Berrian—Machinery stress calculations.
20 K. Hoyer—Turbines and reduction gears.
21 C. Ashby—Boilers.
22 E. F. Hewins—Propeller design.
23 C. B. Palen—Fuels and Fuel Burning Equipment.
24 W. B. Ferguson—Precision of Measurements.
25 H. F. Harvey, Jr.—Electric Propulsion.
26 H. F. Harvey, Jr.—Electric Plants, Wiring and Interior Communication, and Fire Detection.
27 W. A. Gronning—Diesel Engines.
28 G. B. Smith—Classification Rules, Measurements and Scantlings of Merchant Ships.
29 J. W. Owens—Welding to save weight and cost.
30 H. L. Ferguson—Building the ship.

Micro Heavy Duty Internal Grinders

THE heavy duty internal grinder that has capacity for grinding holes from 5 inches diameter and up to 36 inches diameter by 60 inches deep has been placed on the market by the Micro Machine Company, of Bettendorf, Iowa. The length of the main bearing is 48 inches by 14 inches diameter. The total eccentric throw of the grinding spindle is 4 inches, and can be increased to 10 inches with a special double eccentric design. The length of the main table is 114 inches by 30 inches wide. The full length and width of the table may be utilized for work mounting as T-slots are provided. The total table travel is 63 inches. The distance from the top of the table to the center of the grinding circle is 24 inches. The height from the spindle to the floor is 60 inches. The large width of the base casting is 42 inches. A 15 horsepower motor rotating at 1,750 revolutions per minute is required for driving the unit. The floor space required is 6 feet by 22 feet.

A variable speed drive is embodied in the machine for regulating the main cylinder speed to suit the diameter of

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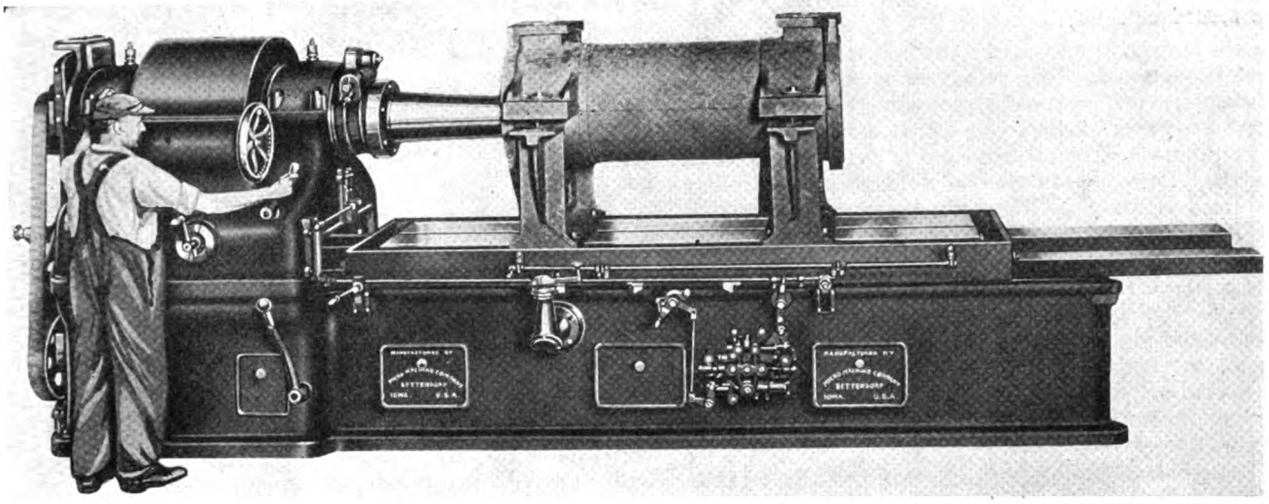


The Micro Model H. G. internal grinder with steamboat cylinder mounted for grinding

the hole to be ground. This change of speed is accomplished with a graduated dial located in the front of the headstock. The Micro pantograph spindle drive supplies a constant speed to the grinding wheel, thereby eliminating the back lash.

The main table is driven hydraulically. This drive provides a pilot valve controlled by one operating lever which permits a wide range of smooth table feeds including rapid traverse.

The automatic eccentric feed mechanism is so designed that the operator may set sliding dogs on side of the table to increase the depth of grinding cut at each end of the table stroke automatically. A graduated dial is embodied in the eccentric feed mechanism to permit duplicate sizing of holes quickly.

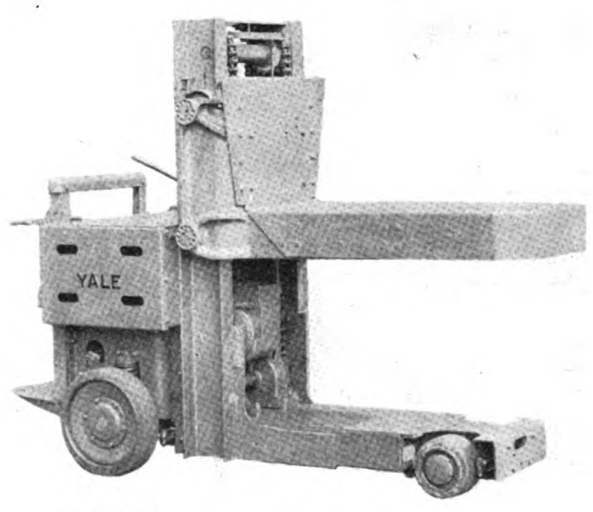
The main cylinder and main table are lubricated with a force feed oil system. The oil is filtered before returning to the bearing surfaces. The slide ways are protected from dust. All revolving shafts are mounted on roller bearings.

New Yale 3-Ton High Lift Truck

THE Yale Model K25, 3-ton high-lift elevating truck has been added to the Yale line in order to fulfill the requirements for ever increasing loads on electric industrial trucks. Advantage has been taken of the excellent features that experience has introduced into the older units, and at the same time the cost has been maintained at a reasonable figure by the use of pressed steel, drop forgings, dies, and general production methods.

The backbone of the frame work comprises mainly a large gusset plate, one-half inch thick, and extending from the very forward end of the truck to the small or trailing wheels. This plate is approximately 24 inches in height, at driving wheel axle, and, in addition to forming the frame work, it provides a yoke to serve as a guide for the drive unit and the spring suspension of the truck. The upright channels or platform roller guides are attached to this gusset plate through ¾-inch diameter rivets, and in addition, by welding strips of steel, either side of the vertical channels to serve as a pocket or guide. By the use of these strips, it is still possible to remove the upright channels for any change or replacement that may be desired. In order to get the necessary stiffness and also in order to provide enough width or surface on which the platform rollers are to bear, a ship channel has been applied.

The elevating platform is raised and lowered through the medium of a 1½-inch diamond roller chain, passing over a power-driven sprocket at the bottom, and an Idler sprocket at the top. In order to reduce friction to a minimum, Hyatt heavy duty roller bearings are employed in the idler sprocket at the top of the machine. The shifts of the lower sheaves run in a bath of oil, which also serves to lubricate the spur-gear reduction unit. The two ends of the roller chain are attached to the platform through a spring take-up device, which will automatically adjust it-



New Yale high lift truck

self as the chain wears. It is estimated that the life of this hoisting chain in normal service will exceed five years.

The hoisting motor is connected to the spur-gear pinion through a spring ratchet, so arranged that a positive drive is obtained when raising the elevating platform. If, however, the platform was checked in its downward travel, the ratchet would merely release, and, therefore, cause no injury to the mechanism of the truck. The ratchet when slipping makes considerable noise, so that the operator is immediately warned of the fact that the truck platform is bearing on some obstruction. Due to the high efficiency of the roller chain and the spur-gear reduction in the hoist unit a speed of 7½ feet per minute is obtained when lifting a full load, and a speed of 19 feet per minute when raising

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the empty platform. The lowering speed is 19 feet per minute loaded or empty.

The elevating platform of the truck is supported in the horizontal position by four rollers bearing on the inside of the flanges of the vertical ship channels. These channels have a depth of 9 inches and a flange of 3½ inches, so that a relatively large diameter roller, with a wide face, is possible. To reduce friction to a minimum, the rollers are equipped with Hyatt "heavy duty" roller bearings, and with a hardened steel thrust washer to take whatever end thrust may occur when lifting loads that are not placed on the center line of the platform. The pins which serve as a spindle for the roller bearings are made eccentric, so that by rotating the pins the platform may be tilted upward or downward to compensate for any wear that may result, after a period of years, on the surface of the rollers and on the face of the vertical channels. The platform members are heavy steel castings, having large diameter bosses to support the platform roller pins. The castings are shaped to reach around the vertical channels and at the same time permit the use of an elevating platform narrow enough to clear standard skids. The platform has an overall width of 27 inches, a height of 11 and a length of 54 inches.

By placing the elevating or hoist unit between the vertical roller channels, all of the available space is utilized, with the result that the overall length of the machine when in operating condition is cut to a minimum. The hoist unit in this position is accessible for any servicing or inspection that may be required, and provides the further advantage that it separates the elevating roller channels a distance sufficient to give a very high degree of visibility for the operator when driving the machine.

Main Drive Unit

The main drive unit is of the double reduction spur-gear type, driving the wheels through totally enclosed universal joints. The entire gear reduction with its differential and bearings run in a bath of oil.

In order to reduce the physical effort necessary to steer a machine of this heavy capacity, the steering knuckle king pins have been fitted with ball and roller thrust bearings which puts the entire weight of the machine on anti-friction bearings. On the small wheels, which come directly beneath the load, the steering knuckle king pins, in addition to being fitted with the roller thrust bearings, are also equipped with an upper and lower roller bearing to take the radial load. These small wheels are fitted with roller bearings on all the moving parts and each wheel assembly contains five bearings. Tests made with this machine carrying the full capacity load of 6,000 pounds show that the pressure required at the operator's handle to steer the wheels is less than was formerly required on the 2-ton machines which were equipped with hardened pins and ground bushings where roller bearings are now employed.

Has Short Turning Radius

A four-wheel steer feature allows a turning radius of 96 inches to the outside edge of the truck.

The design and strength of the joint between the vertical roller channels and the structural frame members make it unnecessary to have any trusses or structural members reaching diagonally from the top of the roller channels to the operator's back-rest. By omitting these braces, it is possible to leave the top of the battery box clear and permit servicing or watering of the battery, without sliding out the battery, or performing any other laborious operation. The battery itself may be removed by hoisting it out of the battery box, or else by removing the side plate to the box and sliding the battery out sideways.

The Cause and Effect of Oil Engine Piston Seizures

By A. B. Newell

THE old hand at oil engine operation who has never witnessed a piston seizure is fortunate indeed, and the one who never will is even more fortunate. However, they are not common and we do not have to take care of them in a routine manner as we do the pits in exhaust valves and loose bearings. They are in a measure an accident, yet not a serious one always, and they occur for various reasons with which we will treat directly.

The symptoms are so pronounced that no engineer would attempt to keep the engine in operation once they become manifest, even though it were possible, which it is not. If the operator does not reach the engine in time to stop it, it will stop itself as the result of the frictional load which builds up very rapidly as the spot which is seizing becomes larger. First the engine will slow down and labor heavily, relief valves sometimes lift and shoot smoke and fire while heavy knocks occur in every bearing that is the least bit slack.

Sometimes when the seizure is not caught in time the crank bolts part and the foot of the connecting rod comes flying out through the side of the engine frame. That is merely the possible result of the engineer not being on the job and is by no means a common occurrence. When it does occur we generally find that the crank bolts have been weakened previously, possibly as the result of sledging down on the nuts too hard and stretching the bolts beyond their elastic limit or through allowing the bearings to run slack and pound thus bringing about crystallization of the bolts.

They generally have sufficient strength to stop the engine under full load plus the inertia force of the flywheel minus the load which the engine carries at the time, no matter what this latter may be.

A mistake which is commonly made when seizures occur is to keep the engine turning over slowly, thinking thereby to prevent the piston from "freezing" in the cylinder. It is entirely safe to stop the engine the instant a seizure begins or at any time thereafter, for as soon as the power is shut off and the engine comes to rest the surfaces which have been in hard contact with each other begin to cool and shrink, thus drawing apart and there is no possibility of them sticking together. If on the other hand the engine is kept turning over slowly, the friction of the two rubbing surfaces will remain so great as to hold the temperature up momentarily at least and considerably more metal will be torn away than would be the case otherwise.

Causes of Seizures

Seizures are the result of excessive heat and local expansion of the rubbing surfaces. This heat is generally the result of friction brought about through lack of lubrication, except in new engines with exceptionally small piston-to-cylinder clearance which may be inadvertently subjected to more load than was placed on them during shop tests, in which event the natural expansion as the result of heavy combustion may cause the piston to more than fill the cylinder, an unlikely condition at best.

Lack of lubrication is more common. It may be the result of poor combustion in which event sooty particles of unburned fuel will mix with the cylinder lubricant and so contaminate it as to cause the rings to fail to function which permits the hot gases to escape by the piston and completely destroy the remainder of the lubricant. In the meantime frictional heat will have started as the result of the poor quality of lubrication. To over-lubricate may cause the rings to carbonize and stick thus bringing about

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a similar condition, while an inadequate supply of oil should need no explanation. No matter why the lubricant may be found missing, seizure is bound to follow unless the lubricant is restored promptly.

Sometimes seizures occur as the result of a stoppage of the cooling water supply in which event the temperature of the cylinders becomes so high as to burn the oil or render the film too thin to carry the load. There is also the possibility of scale formations upon the outer surface of the cylinder liner becoming so thick as to prevent the rapid exchange of heat between metal and water and the effect would be similar to a water stoppage.

Occasionally seizures occur on trunk piston type of engines through no fault of the piston and are the result of an overheated top end bearing which in turn expands the gudgeon pin. The latter, being tight fitting and well fast to the piston, may cause distortion and thus set up a heavy frictional load.

No matter what the cause, the effect is about the same and when a seizure occurs it is enough to make the hair stand on end, for no one can tell what the final result will be until after the engine is stopped.

On one occasion I stood at the lower end of a large cylinder and watched the progress of a seizure while the watch engineer rushed to the throttle to stop the engine, which was of the crosshead type with the open lower end of the cylinder constantly within range of vision. I first saw smoke gushing out with each stroke of the piston. A moment elapsed before I could reach the cylinder. I saw a red hot streak on the cylinder wall each time the piston traveled upward and uncovered it. Before the piston made the return stroke this spot had turned black. On the successive strokes the streak became wider. About 25 such strokes were made before the engine was stopped and the red hot streak remained in existence to the very last dying stroke. About 15 seconds elapsed while I watched, during which time the red hot spot increased in width from about 1 to 5 inches. It is not difficult to imagine what would have been the result of allowing the engine to run another minute or two.

Procedure After Seizure

After a seizure has occurred there is about one safe method of procedure. The piston must be removed and the damaged surfaces reconditioned as best the job can be done.

Accompanying seizure, distortion of the piston often occurs, particularly on engines of the trunk piston type which use no water or oil cooling method. This distortion is the result of excessive heat and expansion of the metal over a comparatively small area which in turn bends the remainder of the casting. Sometimes with the rapid cooling of the hot spot the metal contracts so quickly as to set up a tension and cause a fracture at, or immediately around, the point of seizure.

The damaged spot on the cylinder wall will act somewhat differently. With a rapid heat exchange to the water outside of the cylinder liner the average temperature of the casting at the point of seizure is considerably less than that of the piston. However, one side of the cylinder wall becomes red hot momentarily and expansion must occur. Since the walls are so thick and strong as to prevent such expansion from causing an appreciable amount of distortion throughout their length, bulging will occur at the hot point and the metal will be sheared away with the travel of the rings and piston over it. As cooling occurs with the stopping of the engine, the surface metal will rapidly contract and crack to about the depth of the red hot film. These surface cracks seldom penetrate deep into the casting or weaken the general structure of the cylinder liner to any great extent.

The surface of the seizure on both the piston and cylinder will be covered with a hard blue glazing which should be removed with a grinding wheel or oil stone. To stone the marks down comparatively smooth is a discouragingly tedious job and not necessary. A rough stone may be used. The main object is to get rid of as much of the glazed scale as possible, for although the surface will be found to be lower than the surrounding metal and there is little likelihood of it becoming an immediate wearing surface, as wear of the cylinder occurs later, parts of the glazed spot will come in contact and cut the piston and rings if any of the hard surface remains.

Piston rings which have taken part in a seizure will also be glazed and if it were possible to remove them from the slots without breaking them (which is seldom the case) they should not be used again for they would cut the cylinder wall in place of wearing evenly and to remove the glazing by any stoning or grinding process will throw the ring out of true and even contact with the cylinder wall.

At first thought it might appear that a cylinder which had been thus damaged should not be used for a similar reason but such is not always the case. Seizures generally occur well down the cylinder wall at about the middle of the piston stroke. This is probably due to the fact that the piston reaches its highest velocity at about that point, and on the trunk piston type of engines the connecting rod is standing at the greatest angle and exerting the greatest side thrust at about that point.

Above the seizure there generally remains a sufficient length of clean smooth bore to take care of the highest compression and combustion pressures and such blowing as may occur will be a loss of air or gas at a comparatively low temperature and pressure. For this reason troubles are not likely to reoccur on that account.

On all engines of the crosshead type it is comparatively safe to use a cylinder which has been damaged as the result of a seizure after everything has been cleaned up and the glazing removed. Such is also the case on trunk piston engines except that since the damaged surface will be a bearing surface no longer the surrounding surface will be subjected to greater bearing pressure as the result of the side thrust of the connecting rod and the piston will heat. If this heat becomes excessive, another seizure will occur. In any event the piston will run considerably hotter than it previously did and a long time will elapse before it comes back to normal, if it ever does. A slight frictional power loss will exist but this may be disregarded if no mechanical difficulties arise.

Welded Steel Motor Frame Construction Patented

RECENT patents issued from the United States Patent Office include welded steel motor frames, in which welded steel construction has replaced castings. Patents 1,629,877 and 1,629,876 were issued to James F. Lincoln and assigned to The Lincoln Electric Company of Cleveland, Ohio.

The construction is an assembly of hot rolled steel parts welded into the equivalent of a casting. The claims allowed for the methods of construction cover its use only to dynamo electric machines. According to the statements of The Lincoln Electric Company engineers, it is claimed that the welded steel method of construction gives a practically unbreakable frame, lighter weight and better ventilation.

Steel is 6 times as strong and 2.5 times as stiff, therefore less weight is obtained. Steel also costs only about one-third as much per pound, so that materially less production cost is secured.

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Abstracts of Articles Translated from the Foreign Press

Note on the Application of High Pressure Steam in Light Cruisers

The author studies the choice of pressures and temperatures, and describes the special arrangements of boilers, auxiliary machinery and piping in light cruisers. Thermal equations are also given. He concludes that the use of high pressure steam in this type of vessel should not meet any great obstacles, and mentions that pressures of about 500 pounds and temperatures from 300 to 350 degrees Centigrade only require some special precautions in the layout of piping.—By Rene Therz, Ingenieur Principal GM.

Experimental Study of the Resistance Due to the Formation of Eddies

The author of this paper, E. G. Barrillon, considers separately the resistance of moving solids when deeply immersed and when near the surface. He outlines all the experiments carried out in Germany and France, regarding this particular subject, and compares the results obtained in the two countries. The following are the practical conclusions he draws from the experiments:

1. With the existing $\frac{L}{B}$ ratios used in vessels of high speed, the naked models do not give the eddy resistances.
2. When deeply immersed, their resistance is that due to friction only.
3. Near the surface, if the head of water is equal to $\frac{L}{4}$, the resistance due to formation of waves is negligible.

M. S. Gundersen

This vessel was built by A. B. Gotawerken specially for the fruit trade between Central America and New York. She was built for Norwegian owners to Norske Veritas and Board of Trade requirements. She was 281 feet 11 inches long overall, 267 feet long between perpendiculars, 37 feet 6 inches beam, 24 feet molded depth and 20 feet 8¼ inches draft. The propulsive machinery consists of two 6-cylinder Burmeister and Wain Diesel engines each driving a propeller. They were designed to develop 2,600 indicated horsepower at 170 revolutions per minute. The cylinders are 19.7 inches in diameter by 35.5 inches stroke. A speed of 14 knots is expected. The vessel has two steel decks, one wood deck, a bridge, poop and sunken forecastle. Electric fans are installed in some of the big hold ventilators. All auxiliary machinery is electrically operated. The trial trip took place on April 9 when at a draft of 14 feet 2 inches and 2,500 tons displacement (1,000 tons ballast) a speed of 14.85 knots was obtained at 182 revolutions per minute.—*Teknisk Tidsskrift*, July 16, 1927. One-half page. One diagram.

Experiments with 500 Horsepower Tug Boats

This paper, together with one read in 1925, contains some useful information on trials run with full sized ship, free and towing, and the comparison of these trials with model tank experiments.

The tug boats in question were built for the government during the war and used for transport on the Seine. It was suggested after the war that these vessels might be put in commission on the Rhine, in which case a decrease of about 30 inches in the draft was required, this to be obtained by lengthening the hull. The propeller thus became partially emerged and to maintain its efficiency an arched plate was built over it. The first vessel converted gave excellent results and showed that an efficiency equivalent to that of the vessel with the propeller completely immersed could be obtained.

The trial results of two other converted tow boats given in the 1927 paper fully confirms the conclusions of the 1925 paper.—Abstracted from *Le Journal de la Marine*, June, 1927, and *Bulletin Technique de Bureau Veritas*, June, 1927.

Train Ferry S. S. Schwerin

This ferry is for the service from Warnemünde, Germany, to Gjedser, nearest point of Denmark across the Baltic. This route is only 22 miles long and is the main thoroughfare from Germany to the Scandinavian countries.

The vessel is owned by the German State Railways and built to Germanisher Lloyds highest class with freeboard. The principal dimensions are 350 feet by 61 feet on deck by 52.5 feet on frames by 22.8 feet depth to main deck. The draft loaded is 14.40 feet. The displacement at this draft is 3,540 tons. The full load, including 500 tons train weight, bunkers, etc., amounts to 800 tons. At a speed of 15.5 knots the indicated horsepower is 4,325. The vessel has 11 watertight bulkheads; this is in agreement with the German requirements for ocean going passenger vessels (similar to latest British requirements), making her a two compartment vessel.

A new feature in the design is the complete protection afforded to the railway carriages even at the vessel's extreme ends. There are two railway tracks on the main deck and the carriages can be shipped and unshipped at both ends of the tracks. This necessitates having a great part of the forward above the main deck hinged, while there is no side structure above this deck aft. Each track takes 18 to 20 four-wheel or 7 eight-wheel carriages. The tracks are designed to take 20 tons axle loads of the heavy freight cars. To minimize the vessel's list of 5 degrees when shipping and unshipping carriages on one track at a time, wing ballast tanks are built amidships. The pumping system allows a transfer of 85 tons of water from side to side in 4 minutes.

Model experiments were carried out to establish the best form of after body and disposition of bossing (the vessel is twin screw), and to study the effect of the use of Frahms anti-rolling tanks as a result of which the latter were installed.

In considering the best type of propelling machinery the following is to be remarked: The ferry covers the 22-mile course only four times daily. Out of these four trips two are run with freight cars only at a speed of 11 knots, the other two being passenger trips at the maximum speed of 15.5 knots. Thus the vessel only operates 10 out of 24 hours, having 14 hours in port. The following types of propelling machinery were considered: Steam engines, geared turbines, straight Diesel and Diesel electric. First cost had to be considered in connection with fuel expenses. Owing to the comparatively small mileage covered yearly and the consequent small amount of fuel used the triple expansion engine proved the most economical type of propelling machinery.

Each main engine has 2,200 indicated horsepower. The cylinder diameters are 20½ inches, 31½ inches, 38½ inches and 38½ inches. The stroke is 35½ inches. Each

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engine drives a four-bladed bronze propeller, 11.8 feet diameter by 14.1 feet pitch, governed by the draft and clearance at the dock when the vessel takes a list during loading.

Steam is delivered at 200 pounds pressure by four cylindrical boilers fitted with Schmidt's firetube superheaters and Howden's forced draft.

Spacious promenades and veranda cafes are provided for the three classes of passengers. There are 2 dining rooms to seat 100 persons each.—*Zeitschrift des Vereines Deutscher Ingenieure,* July 30, 1927, 4 pages, 10 photographs.

French Naval Program

A great number of the vessels of the 1922 naval program are now in service. The surface ships of the program include 8,000-ton cruisers, 2,400-ton destroyers and 1,455-ton torpedo boats. A great effort has been made to build light and strong machinery and all the vessels have been successful.

General.—The propulsive machinery consists of high speed turbines running at 3,000 revolutions per minute with simple reduction gearing 1:10. All auxiliary machinery is driven by turbines. The boilers are of the vertical return tubular type, no superheating being used. Waste steam from the auxiliary machinery is used for heating the boiler feed water after this has attained a temperature of 90 to 100 degrees Centigrade. The surplus steam not used in feed water heating goes to the main turbines through automatic valves or to the condensers.

Particulars of the Vessels

Cruisers.—The 8,000-ton cruisers *Duguay, Trouin, Primauguet* and *La Motte Picquet* were all built in the navy yards at Brest and Lorient. Their principal dimensions are 575 feet by 57.8 feet by 15.08 feet draft. The armament comprises 4 double turrets with 6-inch guns and a battery of 3-inch anti-aircraft guns. The turrets are mounted on the centerline, two forward and two aft. The machinery consists of 4 independent Parsons turbines each driving a shaft. Each unit consists of a high pressure and a low pressure turbine with condenser. Forward of the high pressure turbine is a cruising turbine geared to the high pressure turbine and used for low speeds ahead only. The turbines are of the reaction type. Included in the low pressure turbine is the astern turbine, of the impulse and reaction type.

Destroyers.—The 2,400-ton destroyers *Faguar* and *Panthere* were built at Lorient and the *Tigre* and *Chacal* by private yards. Their principal dimensions are 394 feet by 35.3 feet by 11.48 feet draft. The armament consists of five 5-inch guns on the centerline and two 3-inch anti-aircraft guns. The machinery consists of two independent turbine groups, each driving a shaft. Each group consists of two main turbines geared with simple reduction gearing to the shaft. There is also a cruising turbine.

Torpedo boats.—The 1,455-ton torpedo boats *Simour, Tempete, Orage, Ouragan* and *Bourrasque* were built at various merchant shipyards. Their principal dimensions are 328 feet by 32.8 feet by 9.5 feet draft. The armament consists of four 5-inch guns and one 3-inch anti-aircraft gun. Three different types of turbines are used in these vessels. The *Simour* and *Tempete* have Parsons turbines in two groups driving twin screws through intermediate simple reduction gearing. The turbines are of the 3-stage combined impulse and reaction type. The turbines of the *Orage* and *Ouragan* are of the Rateau impulse type consisting of four double and five single wheels. The turbines for *Bourrasque* are of the impulse type, in seven stages, three high and four low pressure. The astern turbine incorporated in the low pressure casing can furnish 35 percent of the normal power.—*Bulletin Technique du Bureau Veritas,* April and May, 1927. Five pages, sketches and photographs.

Characteristics of Propellers

That a propeller should have the greatest possible diameter is true for a single screw vessel.

When the propeller is not in the axis the wake effect is smaller. The diameter of such propellers should not necessarily be the greatest possible. *Rochambeau* and *La Fayette* (quadruple screws) gave good results with screws of 6.6 feet diameter at 400 revolutions per minute, C_b of the *Rochambeau* 0.65. The 6.6-foot diameter propellers are placed at a distance $l = 18.6$ feet from the ship's axis. The ratio of this distance to the vessel's half breadth

$$\frac{l}{B/2} = 0.588.$$

The same propeller when used on the *Charles Roux,* $C_b = 0.53$; $l = 9.75$ feet. $\frac{l}{B/2} = 0.428$ feet; revolutions per minute = 438, gave bad results.

On the *Rochambeau* the ratio:

$$\frac{\text{distance from tip of propeller to hull}}{\text{diameter of propeller}} = \frac{d}{D} = \frac{35}{100}$$

On the *Charles Roux* $\frac{d}{D} = \frac{85}{100}$.

Thus the propeller furthest from the axis of the ship and whose tips are nearest to the hull have given the best results. This is also the experience found on the *Mauretania.*

Pitch Ratio

It was shown in case of the three 18,000-ton cruisers *Condorcet, Diderot* and *Mirabeau* with direct turbine drives that the pitch ratio of the propellers could with advantage be decreased from 0.922 to 0.85 minimum. The same experience has been gained recently in case of Diesel drives. 0.85 is a little on the low side for propellers of more than 10 feet diameter. The paper deals with the effect of using different propeller areas, forms of areas, and number of blades, for high speed vessels of 24 to 30 knots.

The conclusion is drawn that for propellers not in the ship's axis, it is better to use relatively small diameters and great surface areas. It is also advocated in propeller design to make use of Lorain's coefficient $\frac{N\sqrt{P}}{V^2}$, where N = revolutions per minute; P = propeller thrust ; V = meters per second.

A curve is plotted of propeller efficiencies of actual ships to a base of this coefficient.—H. Maroger. *Transanctions of the "Association Technique, Maritime et Aéronautique,"* 1926, 6 pages, 2 diagrams.

World Shipping Approaches Stability.—The present outlook for shipping appears to justify a spirit of optimism according to A. E. Sanderson, of the Commerce Department, Transportation Division. Fundamentally Mr. Sanderson points out the industry has made substantial progress toward stability. Oversea trade has increased steadily, if but slowly, in volume. Only a relatively small amount of tonnage remains to be absorbed into trade, and if the output of tonnage is not inflated a balance between ships and cargoes will soon be restored.

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Questions and Answers for Operating Engineers

Practical information for marine engineers on the operation and maintenance of boilers, engines and auxiliaries

This department is maintained to help those who desire practical information regarding engine room problems or who are preparing to take examinations for a marine engineer's license. Readers are urged to send in questions. Inquiries bearing the name and address of the writer will be answered promptly by mail. If the question is of general interest the answer will also be published in an early issue of the magazine, although the identity of the writer will not be disclosed in doing so. Anonymous communications will not be considered.

Uses of Diesel Engine Indicator

Q.—Aside from power measurement what are the important uses of the indicator in connection with Diesel engine operation?

A.—For measuring compression and determining the effect of changes in adjustment of valves, air pressure, fuel pump, etc., on engine performance, or detecting the occurrence of such changes when they are not intentionally made.

Pointers

Q.—What are "pointers"?

A.—The writer is not familiar with this term and has been unable to find any information relative thereto. It is possible that if the connection in which it was used were known, some information might be given.

How to Refit a Bearing

Q.—How is a bearing refitted?

A.—By scraping the bearing surface of the boxes with steel scrapers until all the high spots are removed and even contact is obtained between bearing and boxes.

Lubrication of Cylinders

Q.—How are the cylinders lubricated?

A.—By means of small oil pumps, assembled into multiple units called mechanical oilers, which are operated by linkages from any convenient moving part of the engine. These pumps feed the oil in drops, at a rate that can be regulated by small adjusting screws, into small pipes leading to the cylinders.

Duties of Diesel Engine Compressor

Q.—For what other purpose is this compressor used besides supplying spray air?

A.—The compressor always has a capacity in excess of the amount required for spraying the fuel. The excess air is by-passed into the starting air tanks to supply air for starting the engine.

Scavenging Pumps

Q.—How is scavenging air for the two-cycle engine provided?

A.—By a low pressure compressor of large capacity operated from the crank shaft in the same manner as the spray air compressor. This scavenging compressor, or pump, as it is usually called, is a single stage machine and lightly constructed, as the scavenging air pressure is usually only about 2 pounds. With some engines the scavenging pump is an independently operated turbo blower, run by electric motor or steam turbine.

Reason for Compressing Air in Three Stages

Q.—Why is the spray air usually compressed in three stages instead of one?

A.—Because the temperature at the end of a single compression would be excessive. By performing the compression in three stages the air can be cooled after each stage in the compression. In this way the heat is easily handled and the amount of power required to compress a given quantity of air is greatly reduced.

Precautions in Handling an Indicator

Q.—What precautions should be observed in handling an indicator?

A.—Never leave it attached to the cylinder when not in use. Clean thoroughly and oil lightly immediately after using. Never hold by pencil arm or parallel motion and never use emery cloth to clean the piston.

Causes of Priming

Q.—What are some of the causes of priming?

A.—Defective design of the boiler, insufficient boiler power, carrying water too high, irregular firing, or opening stop valve too quickly, too small steam space, or pulling the throttle valve on the engine open too quickly. It can be checked temporarily by slowing down the engines and checking the firing until the water becomes quiet.

Why an Engine Knocks or Pounds

Q.—Name some of the reasons that cause knocking or pounding in an engine.

A.—Slack bearings, loose piston, or follower plate becoming slack, a broken piston ring, or follower bolt, piston striking on either end of the stroke, loose thrust bearing and sometimes the liner in the high pressure cylinder becoming loose or slack. Water in the cylinders, due to priming, may also cause a knock or pound.

Advantages of the Steam Turbine

Q.—What are some of the advantages of the steam turbine?

A.—High efficiency with variable loads, no leakage from wear, simplicity of construction, perfect balance, small space occupied, ease of erection, automatic oiling, less danger from condensation, reduced vibration and small friction loss.

How to Take an Indicator Card

Q.—Describe the procedure in taking an indicator card.

A.—Open indicator cock on cylinders, to blow out dirt; attach indicator and slip a card on the drum, drawing it under the clips until it fits the drum smoothly. Adjust

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length of indicator cord so that the drum travel will be slightly less than the limit in both directions. Adjust guide pulley on bottom of drum so that the cord will lead fair, then hook the loop in the cord to the end of the reducing motion. Turn the indicator cock to the vent position, then to the open position and press tracing point lightly against the paper long enough for the engine to make one revolution. Close cock and hold tracing point against paper again to draw the atmospheric line. Have assistant take revolutions, time, pressures, etc., while the card is being taken. Unhook cord and remove indicator immediately.

Pounding in an Air Pump

Q.—What are some of the causes of pounding in an air pump?

A.—Slamming of the valves, caused by an undue amount of water in the pump, loose piston, piston rod loose in crosshead, or a broken valve.

Capacity of Coal Bunker

Q.—How many tons of coal will a coal bunker hold that is 30 feet long, 10 feet high and 8 feet wide, assuming that one ton occupies 43 cubic feet of space?

A.—*Rule:* Multiply the length, breadth and height in feet and divide the result by the number of cubic feet per ton of coal.

$$30 \times 10 \times 8 \div 43 = 55.81 \text{ tons.}$$

Factors involved in Setting a Valve

Q.—What parts of the valve gear are important in the setting of a valve?

A.—The center position of the valve in regard to ports, steam and exhaust laps, the stroke of the valve and the lead and angular advance of the eccentric.

Effect of Loose Propeller

Q.—If the propeller starts to get loose on the shaft, how will this show up in the engine room?

A.—It will cause a vibrating knock to be heard, especially when stopping, starting or reversing the engines.

Result of Omitting Eccentric Liner

Q.—In overhauling a go-ahead eccentric in which there was a ½-inch liner between the eccentric strap and the foot of the eccentric connecting rod, what difference would it make in the working of the engine if this liner were left out when connecting up after overhauling the eccentric strap?

A.—The omission of this ½-inch liner would give too much lead on the down stroke and too little on the up stroke. It would cut off too late at the top and too soon on the bottom. The exhaust would close late and open early on the top and would also close early and open late on the bottom port.

Air Pump Bucket

Q.—Describe an air pump bucket, its valves, air pump rod, etc.

A.—An air pump bucket is a circular casting with a recess around the outside for packing. There are holes in it to allow the air and water to get through with valves to prevent the water leaking back. The air pump rod is made of Muntz metal, brass or some suitable metal that will not corrode.

Repairing Short Circuit in Armature

Q.—Give a simple method of making temporary repairs in an armature in case of a short circuit or open circuit of one of the coils.

A.—Cut out that coil by cutting the leads which connect the coil with the commutator bar and then short circuiting the bar, thus cut out, with the following bar. This may easily be done by simply soldering the two necks together. By this means an armature may be kept in commission until there is convenient time to replace the damaged coils when in port again.

Why Field Coils Heat Up

Q.—Give some of the causes of heating of field coils.

A.—Too high voltage, too low speed, overload, partial short circuit of one coil, too great forward or backward lead of brushes.

Precautions in Connecting Up a Battery of Boilers Under Steam

Q.—What precaution must be taken in connecting up a battery or set of boilers after raising steam?

A.—Be sure that there is not over 2 or 3 pounds difference in the pressure of each boiler so as to prevent a sudden rush of steam from one boiler into the other. Each stop valve must be opened very slowly after being cracked off its seat.

How to Cut Out Generator

Q.—How would you cut out a generator which is running in parallel with others?

A.—Cut down the driving power until it is just sufficient to run the generator empty. This will reduce the load on the generator. Then adjust the resistance in the field circuit until the armature current is at a minimum and then open the main switch. It is usually sufficient, however, simply to disconnect the machine from the busbars, thereby throwing all the load on the remaining machine without having made any previous adjustment of the load or of the field current. Caution must be taken that the field circuit of a generator to be disconnected from the busbars must not be opened before the main switch has been opened; for, if the field circuit be opened first, a heavy current will flow between the armatures.

How to Set a Differential Valve

Q.—Please describe how to set a differential valve, such as is used on ash hoists and steering engines.

A.—In order to answer your question a steering engine similar to that manufactured by the American Engineering Company, which uses the follow-up or differential type of automatic control, has been selected. The steering is assumed to be by trick wheel.

Set the two stop nuts on the control or automatic shaft in such positions that steam will be shut off the engine when the rudder arrives at hard over port or starboard. The guided traveling nut should be set so that it is midway between the nuts when the helm is amidships. With the traveling nut in this position place one of the cranks on horizontal dead center (the engine being of the horizontal type). The valve for this cylinder should now be in mid position, i.e., with top and bottom laps equal. The control or automatic shaft sleeve carrying the operating levers of the control valve stem should be in such a position that the levers are in mid position of their movement. The control valve should now be set so that its top and bottom laps be equal. Now bring the other crank to its horizontal dead center, set its valve so that its top and bottom laps are equal and check the control valve with its levers to see that they have returned to mid positions.

It has been assumed in the above instructions that the center of the pins at the crank carrying the valve stem connecting rods are fixed and have no adjustment.

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Questions and Answers Relating to Naval Architecture and Marine Engineering

Conducted by James L. Bates, Naval Architect, and W. B. Newton, Marine Engineer

This department is maintained for the purpose of answering all questions relating to ships and their machinery. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Function of the Inspection Tank

Q.—Please explain the function of the "inspection tank" as installed in oil burning ships. Is it also installed in coal burning ships?

A.—The steam drains from fuel oil heaters usually lead to a trap or water seal, then to a small inspection tank and thence to the main feed tank.

The object of this tank is to detect leakage of fuel oil from the oil to the steam side of the heater. Should such a leak develop oil may be carried through the feed system to the boilers. In the U. S. Naval service samples of the water from the fuel oil heater drains are required to be drawn off from the tank once an hour and examined.

From the above explanation it may be seen that such a tank would not be installed on coal burning vessels.

Galvanized Pipes in Refrigeration Systems

Q.—Would it be safe to use galvanized pipes in building up an ammonia double pipe condenser?

A.—The use of galvanized iron pipes carrying ammonia has been the cause of much trouble in refrigeration systems. Cases have been cited, when used in condenser oonstruction, in which the ammonia appears to have attacked and absorbed the galvanizing where the hot gas entered, depositing it in dust form in the bottom of the pipes. This chemical action apparently generates a gas of its own, raising the condenser pressure to a point which no amount of purging seems to alleviate, liquid only passing to the compressor.

How to Find Dimensions of Winch Connecting Rod

Q.—If the connecting rod for a gear pump or winch were missing and there were no blue prints to give the dimensions for a new one, how would the engineer get the correct length and other dimensions for making a new one?

A.—A deck winch having horizontal cylinders will be taken as an example. Measure the least inside distance which exists between the head and crank end cylinder heads when in position. Subtract from this the length of stroke plus the thickness of piston. Divide this result by 2 and we have the lineal clearance (about 3/8 inch for an 8¼ by 8-inch engine). Remove the head and place the piston in such a position that if the head were in place there would be a clearance between the piston and head equal to the lineal clearance found above. Now, assuming that the piston rod with its crosshead is of correct length, measure the distance from the crank pin center to the crosshead pin center. Repeat this procedure with the piston and crank at the other end of the stroke and again measure from center to center of the pins. If the two measurements check, we have determined the connecting rod length; if not, then lengthen or shorten the piston rod, as the case may be, to a point at which they do check.

For this same size engine, were it of vertical type, the top and bottom piston clearances would be about 5/16 inch and 7/16 inch respectively.

The various steps involved in determining the details of a connecting rod design will be described in a later issue.

Effect of Throttling Steam Pressure

Q.—(1) A government inspector set a tug's safety valve at 120 pounds by mistake instead of 180 pounds. The tug has been working with 120 pounds for a few weeks until the inspecter came again. I would like to know *what saving of fuel* (if any) would result by only carrying 120 *pounds boiler pressure, using throttle wide open*, instead of carrying 180 pounds at boiler and closing throttle so as to give *same pull on tow line?* The tug is towing pulpwood in "booms" and cannot use her full power, as the wood slips under or over the booms if too much speed is used.

(2) A steeple compression condenser engine seems to make more "hissing" noise than a "fore and aft." Why is this so?

A.—(1) Throttling from 180 to 120 pounds without doing work would produce theoretically about 4 degrees superheat, but the gain from this source would be small and in all probability would be counterbalanced by losses through heat radiation and leakage. It has been proved by experience and experiment that the carrying of higher boiler pressures than necessary for satisfactory operation is uneconomical. In the writer's opinion about 1 percent more fuel would be required when operating at 180 pounds than at 120 pounds per square inch boiler pressure.

(2) I know of no concrete reason why a steepled compound engine should have more of a hissing sound than one of the fore and aft type. It might be due to the fact that steeple engines have more stuffing boxes through which leakage might occur, thus intensifying the sound, though with packing properly designed and fitted there should be no leakage.

Again in steepled engines having the valve stem of one cylinder a continuation of that of the other, the passage of steam through the long ports of the high pressure cylinder might cause a hissing sound.

Douglas Fir vs. Yellow Pine for Deck Planking

Q.—What are the relative merits of Douglas fir and yellow pine for deck planking on ocean going vessels?

A.—Douglas fir is the modern term for Oregon pine. It is accepted for deck planking in ordinary merchant vessels, though the higher class of passenger vessel is usually planked with yellow pine.

The Navy Department specifies teak exclusively for all weather deck planking of capital ships. This is due to its long life, freedom from minor defects, and to some slight superiority as regards uniformity when compared with other woods suitable for planking.

In the past the department has specified for auxiliary vessels either yellow pine or Douglas fir. However, the latest departmental specifications for auxiliary vessels, prepared in 1919, permitted only yellow pine.

In this connection I quote the following from recent reports of Boards of Inspection and Survey:

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"U. S. S. *Nantucket*, January, 1926.—The deck planking is very much worn and very uneven on the upper surface. Many deck bolts and heads are exposed and the thickness of the planking is so reduced as to make it impracticable to reset many of the bolts. One reason for the unevenness of this deck planking appears to be the use of both rift sawn yellow pine and Douglas fir. The wearing qualities of the latter are so inferior to those of the former as to make the deck very uneven."

"U. S. S. *Bridge*, October, 1924.—The wood deck is somewhat uneven in places and this appears to be due to the fact that in some places Douglas fir planks have been used and have worn much more than the pine decking used for the greater portion of this deck."

Yellow pine is believed to be generally better for deck planking than Douglas fir where the available supply of both timbers is such as to afford equal opportunities for selecting high grade material because (a) it is more uniform in quality, (b) the modulus of elasticity is about 2,100,000 as compared to 1,800,000 for Douglas fir, and (c) the modulus of rupture is 12,600 as compared to 9,000 for Douglas fir. However, yellow pine is heavier than Douglas fir, the former running 38 to 43 pounds per cubic foot and the latter 32 to 36 pounds both having about 15 percent moisture.

Where uniformity of appearance is not required and Douglas fir can be carefully selected and worked vertically grained, it should give nearly—if not quite—the same satisfactory service as yellow pine. This appears to be somewhat contradictory to what has gone before; however, it is explained by the fact that the supply of Douglas fir is so much larger than that of yellow pine that a far better quality can be obtained in the present market than is the case with yellow pine.

In view of the foregoing, the case for Douglas fir appears to be very strong when the relative length of life and prevailing market prices are considered. Teak, yellow pine and Douglas fir are related in cost per thousand about as 5, 2 and 1. The life of a teak deck is from 25 years up; that of yellow pine and Douglas fir, under present day conditions, probably from 8 to 12 years.

Books on Electricity

Q.—Please recommend a book on electricity for use on board ship.

A.—To my knowledge there is no electrical book strictly applicable for use aboard ship. Any of the several following books should be of value in a ship's library:

Elements of Electrical Engineering, (2 volumes). Vol. 1—Direct Currents, Vol. 2—Alternating Currents. By Franklin and Esty. Published by the Macmillan Company, New York.

Lessons in Practical Electricity, by C. Walton Swoke, published by D. Van Nostrand Company, New York.

Naval Electrician's Text Book, by Capt. W. H. G. Bullard, U. S. N. published by the United States Naval Institute, Annapolis, Md., in two volumes, Vol. 1—Theoretical, and Volume 2, Practical.

The last named books are built around United States naval practice.

Evening Course on Oil Engines

FOR the fifth year, the Brooklyn Polytechnic Institute, 99 Livingston street, Brooklyn, N. Y., is offering an evening course on Diesel engines in order to aid practical men in obtaining a knowledge of the fundamentals that underlie the use and construction of oil engines. Twenty 2-hour lectures are given during the winter on every Friday evening at 7:30 p.m. beginning with the first Friday in October. The lecture course is also supplemented by class room exercises and laboratory periods which are held on every Tuesday evening alternating each week between laboratory periods and class work consisting of oral discussion and written tests. The course is given under the personal supervision of Professor E. F. Church, Jr., head of the department of mechanical engineering. The lectures are prepared and delivered by Edgar J. Kates, consulting engineer and chairman of the oil and gas power division of the American Society of Mechanical Engineers. Professor W. J. Moore is in charge of the engineering laboratory work and assistant professor F. D. Carvin will conduct the class room discussions and tests. The fee for the lecture course alone is $25. For the class room and laboratory instruction in addition, the total fee is $55.

LETTER TO THE EDITORS

Machinery of the U. S. Warships Atlanta and Boston

BROOKLYN, N. Y.

TO THE EDITORS:

I have just been reading the editorial in your September issue relative to the death of Admiral Bowles, which brings to mind some of the incidents and experiences of my early life in New York city. Reference is made to the first four steel ships of the then new U. S. Navy. I had the privilege (I considered it a privilege) of working on the construction and installation of the engines and auxiliaries of two of those ships, namely, the *Atlanta* and the *Boston*—sister ships. This was in 1884.

The ships were built in Chester, Pa., but the engines and boilers were built in the old Morgan Iron Works (John Roach Company) at the foot of East 9th Street, New York city. Work on the engines for the *Atlanta* and *Boston* began during the early part of 1884, and was completed during the spring of 1885. The installation of the engines of the *Atlanta* was made first, those of the *Boston* following.

A brief description of these engines follows. They were three cylinders compound (one high pressure and two low pressure cylinders—the high pressure between the two low pressures) horizontal, *back acting* or *return connecting rod* marine steam engines. Each low pressure piston had *two* piston rods which spanned the crank shaft diagonally, and connected to a yoke crosshead, to which the return connecting rod was attached. The high pressure piston had but one rod, but two yokes and two rods to span the shaft. I do not remember the exact cylinder sizes, but they were *approximately* 38 inches by 72 inches by 42 inches stroke. The pistons were of cast brass attached to steel rods. (I often wondered how they could be kept tight when the expansion of different metals is considered.) In brief, these engines were of peculiar design and construction when viewed in the light of modern equipment.

The boilers were of the Scotch type equipped with *composition tubes*.

The engines of the four ships mentioned in the editorial were built under the general supervision of Mr. Henry McCullugh and installed in the respective ships under the direction of Mr. Henry Rodman, who was the outside foreman at the time. The man actually in direct charge of the construction, erection and installation of the engines of the *Atlanta* and *Boston* was Mr. Darius Gallagher.

The boilers of all the ships were built and installed under the general supervision of Mr. Daniel Quinn, a one time Congressman.

During the progress of the work, from the beginning to the end, a naval engineer inspector was on the job every day. I do not happen to remember his name at present.

I thought the foregoing bit of history might be of interest to readers of MARINE ENGINEERING AND SHIPPING AGE at this time. CHARLES J. MASON.

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NEW BOOKS

Salvaging of Sunken Ships. By E. Grundt, S. T. Lavraft and K. Nechajew. Size, 7 by 10½ inches. Pages, 315. Illustrations, 167. Berlin, Germany, 1927: Richard Carl Schmidt and Company.

In this work has been brought together much information of salvage operations, comprising as it does the literature of widespread technical publications, all of which is very ably presented. The first part of the book deals mostly with stability, after this follows an extensive description of the different kind of salvaging apparatus in use. The latter part of the book is the most interesting, as it gives a summary of the particular operations carried out in the order of the methods applied. Legal questions are set forth at the end, together with a list of German patents.

On the Question of Ship Resistance. By Ch. Doyère, Director of Naval Construction in France (Translated into German by W. Meienreis). Size, 7⅞ by 11 inches. Pages, 34. Illustrations, 10. Berlin, Germany, 1927: Verlag Julius Springer.

While much valuable material has been published in this country and abroad of the results of model experiments, a comparatively small amount of this has reference to the relation of the model experiment results to those of the full-sized ship, which is brought out in this publication. The results are those obtained in the French tanks at Grenelle, and deal particularly with a great number of experiments carried out with models of 5,000 and 6,000-ton cruisers. The author is to be congratulated upon his method of presentation of results. The form resistance for tons displacement at different speeds are plotted to a base of $\frac{L}{3\sqrt{D}}$, thus making their application very easy. The book should prove valuable to readers engaged in ship design.

Motorship Manual and Register of Motor Vessels. Fifth edition. Edited by A. C. Hardy, B.Sc Size, 7⅝ by 10¼ inches. Pages, 228. Numerous illustrations. New York, 1927; Motorship.

Formerly known as Motorship Year Book, this volume has become a standard reference book on oil engines and motor vessels. It contains a complete register of all vessels with oil engines of 300 shaft horsepower or over arranged year by year in alphabetical order together with an alphabetical index of all the motor vessels. The register is arranged in tabular form with columns giving the following particulars: Ship's name, shipowner, shipbuilder, principal dimensions, tonnage, type of engine, number of cylinders, cylinder diameter, stroke, revolutions per minute, number of engines and total horsepower.

Aside from its value as a register of motor vessels, over 50 pages of the book are taken up with illustrated descriptions of marine oil engines on the American market. Another section comprising about 50 pages gives illustrated descriptions of the principal noteworthy motorships completed during 1926 and 1927. This is followed by a list of typical questions given by the Steamboat Inspection Service to applicants for a Diesel engineer's license. Various other subjects covered in the book are: Marine Diesel lubrication, conversion of viscosities, motorship pump equipment, the world's oil bunker stations, electric switchboards, batteries and other electrical equipment and Diesel engine classification rules as specified by the American Bureau of Shipping and Lloyd's.

PERSONAL MENTION

Lyndon B. Fitch, traffic manager for Swayne & Hoyt, has been named chairman of the recently organized Gulf Conference to serve for the coming six months.

Walter Tobey, who has been connected with the Boston office of the United States Lines for some time, has been promoted to the position of assistant general agent.

Horace Crystal has been appointed manager of the operating department of the Philadelphia offices of Moore & McCormack, succeeding Robert T. Smith resigned.

C. E. Pepper, chief engineer for the past year of the S.S. *Jomar*, has been appointed assistant port engineer of the Lykes Bros-Ripley Steamship Company, Inc., New Orleans, La.

George T. Williams, who has been relieving boarding officer at San Francisco, Cal., has been appointed to fill the vacancy caused by the death of William Sprague, who died some time ago.

John Sonderman, formerly connected with Furness, Withy and Company, and various other important shipping lines, has been appointed manager of Moore and McCormack's offices in Baltimore.

L. H. Korndorff, vice president and general manager of the Federal Shipbuilding Company, Kearny, N. J., has been elected president of the company succeeding the late Charles W. Bryan who died recently at his home in New Rochelle.

Michael J. O'Connell of E. I. du Pont de Nemours and David Cook of Sanderson & Son, Ltd., were admitted to membership in the Maritime Association of the Port of New York at a meeting of the board of directors on September 14.

George W. Edmonds, formerly congressman and chairman of the Committee on Merchant Marine and Fisheries during part of his twelve years in the house, has been appointed manager of the Port of Philadelphia Ocean Traffic Bureau to succeed B. Hoff Knight.

Robert T. Smith, who recently resigned as manager of the operating department of the Philadelphia offices of Moore & McCormack, has been appointed manager of the operating department of B. H. Sobelman & Company, Philadelphia, with offices in the Bourse Building.

John Olsen, formerly of the United States Lines and recently of W. & A. Fletcher Company, Hoboken, N. J., has resigned as supervisor to accept a position as assistant superintendent engineer of the Cosmopolitan Shipping Company, New York, relieving Andrew S. Varni, resigned.

V. W. Ring, purchasing agent of the United States Shipping Board for Port Houston, has assumed his duties, it was announced at that port. Mr. Ring will have charge of purchasing supplies for Shipping Board vessels calling at Port Houston. Previously this work was handled by the Galveston office of the board.

R. L. Wilson, works manager of the East Pittsburgh Works of the Westinghouse Electric and Manufacturing Company, has been appointed assistant to vice president and general manager, and J. M. Hipple, manager of the company's motor engineering department, has been promoted to the position of works manager.

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Commissioner P. S. Teller, Pacific coast member of the United States Shipping Board, will leave Washington shortly for an inspection trip of shipping facilities on the Pacific coast. The trip is to be of an unofficial nature, but he will investigate shipping conditions along the entire Pacific coast. The trip will be of about a month's duration.

Charles E. Cook, formerly connected with the American-Hawaiian Steamship Company, San Francisco, has been appointed traffic manager of Swayne & Hoyt, Inc., San Francisco, the firm which has just been appointed Pacific coast agent for the Calmar Steamship Corporation, a subsidiary of the Bethlehem Steel Corporation which is instituting a new intercoastal service between Atlantic and Pacific ports.

E. C. Geehr, formerly purchasing agent for the William Cramp and Sons' Ship and Engine Building Company, has been appointed purchasing official of the Marine Engineering Corporation by J. F. Metten, president. This company was organized by shipyards having naval contracts for the purpose of designing scout cruisers for the United States Navy, with offices in the Steel Building, 15th and Cherry Streets, Philadelphia, Pa.

At a regular meeting of the directors of the United Fruit Company, held in Boston on September 13, William Newsome was designated as senior vice president; W. K. Jackson was appointed vice president and general counsel, and Claude D. Doswell, Mathew C. O'Hearn and Hartley Rowe were named vice presidents, with duties to be assigned by the president, Victor M. Cutter. Arthur E. Nicholson was appointed secretary of the company, effective October 1.

G. B. Moore of Kansas City, traffic manager of the Merchant Fleet Corporation for Europe, has been appointed traffic manager of the New York district, effective October 1, succeeding E. J. Freeze, who has resigned. The vacancy created by Mr. Moore's transfer will be filled by the transfer of W. A. Spencer, manager of the European and Mediterranean trades division of the traffic department at Washington. The Shipping Board also approved the appointment, by transfer, of B. Y. Martin, assistant manager of the agreements and adjustments division, operation department, to fill the position of agent for the Merchant Fleet Corporation at Shanghai, China. He succeeds W. I. Eisler, who resigned on July 19.

Andrew S. Varni, for the last eight years assistant superintendent engineer of the Cosmopolitan Shipping Company, New York, has resigned his position to become associated with the United States Salvage Association, New York, as marine surveyor. After graduating from Manual Training High School of Brooklyn, N. Y., Mr. Varni served his time as apprentice machinist with the Warren Manufacturing Company. He spent fifteen years at sea in various capacities, rising to chief engineer. During the war he was commissioned to senior grade lieutenant and was stationed at the United States Navy Steam Engineering School, Stevens Institute of Technology, as an instructor in marine engineering and naval architecture. He also served as chief engineer on Diesel vessels and was also connected with the New York State Nautical School Ship *Newport* as first assistant engineer and instructor.

Paul Hecht, of the South Philadelphia Works of the Westinghouse Electric & Manufacturing Company, has been appointed assistant to the vice president of the company. Mr. Hecht was first employed by the Westinghouse Machine Company in 1905, beginning his activities in the production department. In 1906 he was transferred to the contract manager's department, and in 1907 to the sales department, where he remained until 1914, when he joined the Export Company, now the Westinghouse International Company, heading up sales negotiations of machine works apparatus. In 1916, he became employed in the department of price and estimating, and in 1920 moved to the South Philadelphia works in this same work. He carried on this work, besides many special duties, until his recent appointment. During twenty-two years of service Mr. Hecht has traveled widely in Germany, Great Britain and Belgium. He was the executive in charge under the vice president of erecting the new turbine blade shop and the transferring of the blading activities from East Pittsburgh to South Philadelphia. He is a member of the American Management Association, the Philadelphia Chamber of Commerce and the American Society of Mechanical Engineers.

James K. Ingham, who for several years has been a member of the staff of Theodore E. Ferris, naval architect and marine engineer, 30 Church street, New York, has been at the Krupp shipyard, Kiel, Germany, since last spring as Mr. Ferris' personal representative supervising the construction of the million dollar 260-foot yacht designed by Mr. Ferris for Mr. Vincent Astor of New York. Mr. Ingham is handling the business end of the transaction with the Krupp people so far as it can be done in Germany and is also directly responsible for inspection of materials and workmanship. He will be at the Krupp yard until the vessel is finished early next year. Messrs. Cox & Stevens, well known yacht specialists, are handling the interior designs and decorations of the yacht. Mr. Ingham has had a great deal of outside yard experience, having been for a number of years on the inspection staff that Mr. Ferris maintained at the yard of the Newport News Shipbuilding and Dry Dock Company, Newport News, Va., during the construction of twelve passenger and freight ships. Previous to this, Mr. Ingham was chief draftsman for the Seattle Construction and Dry Dock Company for a period of about five years until the yard was forced to close due to lack of work. He comes of a family that has been connected with shipbuilding activities for many years, his father, Alfred T. Ingham, being well known as general manager at one time of one of the large American shipyards.

James K. Ingham

Archibald D. Black, who has been an official of the Toledo Shipbuilding Company for 22 years, has resigned. He has been assistant to the president, secretary, assistant treasurer and a director of the company. Before going to Toledo Mr. Black was connected with the shipbuilding industry in Detroit.

J. Burton Ayres of Cleveland has been elected a director of the Toledo Shipbuilding Company, Toledo, Ohio, and also secretary and assistant treasurer of the company, succeeding A. D. Black, resigned.

F. B. Hufnagel of New York, president of the Crucible Steel Company of America, has been elected a director of the Toledo Shipbuilding Company, Toledo, Ohio.

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The Month's Shipping and Shipbuilding News in Brief

Shipyard, Steamship and Port Activities and Other Notes of Interest in All Branches of the Marine Industries

Plan to Recondition Agamemnon and Mount Vernon Again Revived—Gibbs Bros., Inc., to Prepare Specifications

ADVICES from Washington have been received indicating that the plan to recondition the ex-German liners *Agamemnon* and *Mount Vernon* for trans-Atlantic service has been revived.

Authorization was given at the Shipping Board meeting on August 13, to Admiral Benson, commissioner in charge of the Bureau of Construction and Maintenance, to have the firm of Gibbs Brothers, Inc., New York, and Admiral D. W. Taylor, United States Navy (retired), prepare plans and specifications for reconditioning these vessels. It is understood that the naval architects will immediately proceed with the specifications and have bids submitted on the work in the near future so that they may be presented to Congress at the next session.

The proposal submitted by William Francis Gibbs and Admiral Taylor suggested four methods for reconditioning the ships and the plans will be prepared according to method A as approved by the board. This plan calls for reconditioning the *Mount Vernon* and *Agamemnon* at a cost of $6,000,000 each, and estimates net profits from operations for each vessel amounting to $1,278,809, less interest and amortization of reconditioning cost of $870,000, bringing the estimated net result per annum to a profit of $402,809.

In addition to the complete rehabilitation of the accommodation on these vessels the plan also includes reconditioning of all machinery and the installation of new turbines to be supplied with steam by water-tube boilers. The required speed for the vessels will be 20 knots.

The general consensus of opinion of the Shipping Board is that the reconditioning of these vessels should receive the approval of Congress prior to any action being taken on the construction of new liners, as it is believed that some effort should be made immediately to provide a more representative trans-Atlantic service as soon as possible, while plans for future development are being considered. If the present plan meets with approval of the board and is authorized by Congress, the two liners could be placed in service in the spring of 1929.

Pennsylvania R.R. Opens Bids for Steamer to Replace the Maryland

THE Pennsylvania Railroad opened bids Monday, September 19, for the construction of a passenger steamer to be used by the New York, Philadelphia & Norfolk Rialroad Company between Cape Charles and Norfolk. This vessel will be put in service as a replacement for the steamer *Maryland*. It is understood that the general characteristics of the new steamer will be approximately the same as the *Maryland*, which had a length of 249.5 feet, a breadth of 40.1 feet and a depth of 14.1 feet. The *Maryland* was equipped with two 3-cylinder triple expansion engines developing about 1,900 indicated horsepower.

Berwind-White Company Plans New Fleet of Colliers—Will Burn Pulverized Coal as Fuel

INFORMATION has been received from unofficial sources that plans and specifications for the construction of colliers for the Berwind-White Coal Mine Company, New York, are nearing completion. The work is being handled by Theodore E. Ferris, naval architect, 30 Church street, New York City.

It is believed that two of these colliers will be ordered at first although as nearly as can be learned at this time the company intends to eventually operate an entire fleet of the new type. Delays in the preliminary work have been caused by the design of special machinery and equipment for the vessels. Radical changes in the propulsion machinery may be expected among other things as it is understood that turbines operating under 400 pounds per square inch steam pressure will be installed. This steam will be supplied by water tube boilers burning pulverized coal as fuel.

This plan developed by a commercial organization is extremely interesting in view of the general attention now being attracted to pulverized coal as fuel in marine installations and will add greatly to the impetus given the movement begun by the tests of the Shipping Board Fuel Conservation Section at the League Island Navy Yard and followed by the present work of converting the Shipping Board steamship *Mercer* to a pulverized coal burning vessel.

Further details of the characteristics of the contemplated collier fleet will soon be available.

Newport News Yard to Build Tugboat for C. & O. R.R.

A CONTRACT has been placed by the Chesapeake & Ohio Railroad, Purchases and Stores Department, Richmond, Va., with the Newport News Shipbuilding & Dry Dock Company, Newport News, Va., for the construction of a tug boat which will have a length of 120 feet. The tug boat will be equipped with reciprocating steam machinery of 1,000 indicated horsepower. Bids for the work were opened last month by the Chesapeake & Ohio Railroad Company.

The Ann Arbor Railroad car ferry *Wabash*, described on page 433 of our August issue, is equipped with a Sperry gyro compass.

Shipping Board Awards Contracts for Eight Diesel Engines

THE United States Shipping Board, Washington, D. C., has awarded contracts for the construction of eight Diesel engines for installation in Shipping Board cargo vessels. The ships to be converted to motorships under this program have not been selected, but action to this end will be taken at some time prior to completion of the engines. The contracts which have been awarded are as follows:

Worthington Pump and Machinery Corporation, New York, two 3,625 brake-horsepower, two-cycle, double acting, internal combustion engines, with two Elliot scavenging blowers, at a price of $536,500 for both engines.

McIntosh and Seymour Corporation, Auburn, New York, two 3,900 brake-horsepower, four-cycle, double acting, internal combustion engines, with "longest piston and most piston rings," for the price of $577,200 for both engines.

Busch-Sulzer Brothers-Diesel Engine Company of St. Louis, Mo., two 3,950 brake-horsepower, two-cycle, single acting internal combustion engines, with two Elliot scavenging blowers, at $584,600 for both engines.

Hooven, Owens, Rentschler Company of Hamilton, Ohio, two 4,000 brake-horsepower, two-cycle, double acting, internal combustion engines, with two A. B. and B. Corporation scavenging blowers, for the price of $592,000 for both engines.

The time which will be required for completion of the engines will be approximately 185 days.

Moore and McCormack Bid for Scantic Line Accepted—May Build Six New Vessels Under Terms of Agreement with Shipping Board

THE bid of $281,820 submitted by A. V. Moore and E. J. McCormack, of New York, on behalf of a corporation to be organized, was accepted recently by the Shipping Board for the American Scantic Line, operating from North Atlantic ports to Baltic and Scandinavian destinations. In accepting the bid, the board and the purchasers subscribed to an understanding that in event new tonnage could be built on a parity with construction costs abroad the new vessels would be substituted for the present tonnage and operated for a period of ten years.

"An understanding will be had, however, that if at any time during the five-year period it becomes possible by reason of Federal legislation or otherwise for the buyer to construct in the United States vessels suitable for operation on the line

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and to operate them under American registry at a cost approximately not in excess of the cost of foreign construction and operation, the buyer will so construct six vessels suitable for operation on the line and substitute the same for vessels operated pursuant to the terms of the original contract. In such event the period of guaranteed operation will be ten years from the date of delivery of the first vessel instead of five years."

Under the bid, the purchasers obtain the *Argosy, Bird City, Casper, Minnequa, Sagaporack* and *Schenectady*, each of 7,825 deadweight tons.

Firm of Gibbs Bros. Issues Plans for Converting Three Shipping Board Vessels to Diesel Electric Drive

PLANS and specifications have been issued by the firm of Gibbs Bros., Inc., 25 Broadway, New York, for the complete work of remodeling the hull and installing machinery on 3 Shipping Board freight vessels which are to be converted from steam to Diesel electric drive. Bids for this work will be opened Monday, October 3, at the naval architect's office. Authorization for the asking of proposals by Gibbs Bros., was recently given by the Shipping Board on the basis of a report prepared by William Francis Gibbs, working in collaboration with Rear Admiral David W. Taylor, formerly chief constructor of the Navy, which outlined a method for increasing the speed of the vessels in question which are the *Courageous, Defiance* and *Triumph*, each having a capacity of 11,773 tons deadweight.

Briefly, the specifications call for the alteration of the bow of each vessel by the addition of 11 feet to the length; for the installation of new stern frames and rudders, the elevation of the propellers to a slight degree and complete rearrangement of engine spaces, oil tanks and the like to accommodate the new machinery.

The bids will also include, as noted above, prices for the complete machinery installation, including main engines which will consist of four 1,200 horsepower Diesels, electric generators and propelling motors and all auxiliaries.

The following shipyards have been asked to submit bids for the conversion work on these ships: Bethlehem Shipbuilding Corporation, Ltd., New York; Sun Shipbuilding & Dry Dock Company, Chester, Pa.; Federal Shipbuilding & Dry Dock Company, Kearney, N. J.; Staten Island Shipbuilding & Dry Dock Company, Staten Island; Newport News Shipbuilding & Dry Dock Company, Newport News, Va.; Morse Dry Dock & Repair, Brooklyn, N. Y.; Todd Shipyards & Dry Dock Company.

Proposals Asked for Construction of 150-Foot Diesel Yacht

INFORMATION has been received that figures are being asked by John H. Wells, naval architect, New York, for the construction of a Diesel yacht. It is understood that this yacht will have a length of about 150 feet. No additional details are available at this time.

Contract for Installing Pulverized Coal Burners on S.S. Mercer Awarded Maryland D. D. Co.

A CONTRACT has been awarded by the United States Shipping Board to the Maryland Dry Dock Company, Baltimore, Md., to carry out hull changes and installation of equipment and burners for pulverized coal fuel on the steamship *Mercer*. The bids were received and opened at the office of Carl J. Jefferson, head of the Fuel Conservation Section of the United States Shipping Board, 45 Broadway, New York, on August 31. The Maryland Dry Dock Company submitted a bid of $36,498.

The burners and distributing equipment to be installed in this vessel have been purchased by the United States Shipping Board from the Peabody Engineering Corporation, New York, the pulverizer equipment from the Kennedy-Van Saun Engineering Company, New York, and the conveyor equipment from the Link Belt Engineering Corporation, New York. It is believed that the work will be completed and the vessel made ready for use in about 30 days' time.

Fleet of Four-Day Transatlantic Liners Proposed

A GREAT deal of comment in shipping circles has been caused recently by the proposed new transatlantic service to be operated by a company to be known as the New York-London-Paris Steamship Company (Blue Ribbon Line). As outlined in the publicity for the proposed company, the line would operate ten quadruple screw turbine ships of 20,000 tons gross register at a speed of 31½ knots. The vessels would have a length of 800 feet, beam 80 feet and 24.9 feet draft. Turbine machinery of 100,000 to 130,000 horsepower would be required. One of the major features of the ships, as planned, would be an unobstructed flying deck from which airplanes could take off and land. To accomplish this, the funnels would be placed at one side of the hull in a position similar to the design of the airplane carriers *Lexington* and *Saratoga*.

The terminal on this side of the ocean would be Montauk Point. The run could be made in 4 days and for individuals desiring to do so, this time could be shortened by flying to the ship after leaving port or taking off by plane at some point in the Atlantic.

It is understood that tentative plans have been drawn by Ernest H. Rigg, naval architect, for the American Brown Boveri Electric Corporation, Camden, N. J., in consultation with Theodore E. Ferris, naval architect of New York. Among those connected with the proposed project are: H. B. Walker, president of the American Steamship Owners' Association and former president of the Old Dominion Line; Joseph E. Sheedy, former vice-president of the Merchant Fleet Corporation in charge of European affairs, and Laurence R. Wilder, president of the American Brown Boveri Electric Corporation.

It is hinted that the project will have the backing of the Pennsylvania Railroad by reason of its control of the Long Island Railroad, which would form an important link in the proposed service inasmuch as the bulk of the passenger traffic would pass through New York to and from Montauk Point.

Plans for New Ferryboat for New York City Nearing Completion

PLANS and specifications, which have been under peparation for some time by the Department of Plants and Structures, New York city, for the construction of a ferryboat which is to be a sister vessel of the *American Legion*, are now nearing completion and it is expected that they will be issued within the next few weeks. These plans, which have been prepared by R. W. Morrell, naval architect, for the Department of Plants and Structures, of which A. Goldman is commissioner, have been held up slightly pending a decision on certain changes and improvements which are to be incorporated in the new ferryboat. Once the points in question have been settled, it is believed that no further delay will be caused in the authorization of the work by the Board of Estimates.

The general details of the ferryboat will be:

Length overall	264 feet
Breadth over guards	66 feet
Depth of hull at guard	19 feet 4 inches
Draft in operating condition	12 feet 6 inches

So far as is known, few changes will be made in the propelling machinery from that installed on the *American Legion*, which is equipped with two vertical compound steam engines coupled together developing about 4,000 indicated horsepower.

Golden Gate Ferry Co. Awards Contract for Ferryboat and Electrical Machinery

THE Golden Gate Ferry Company of San Francisco, Cal., recently awarded to the General Engineering and Dry Dock Company, San Francisco, a contract for the construction of a fourth Diesel electric passenger and automobile ferry boat.

The electrical machinery for the new vessel will be supplied by the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., which firm supplied equipment for the first three ferry boats *Golden Bear, Golden Poppy* and *Golden Shore*.

The principal dimensions of the vessel, which will be of the double ended type and a sister ship of the other three, are as follows:

Length overall	240 feet
Beam	44 feet
Draft	13 feet

She will have a gross tonnage of 780 and a capacity of 350 passengers and 85 automobiles. Her speed will be 13 knots.

The propulsion equipment will consist of three generating units which supply power to two propulsion motors, one for each end of the vessel. Each generating unit will comprise a 460 brake horsepower Ingersoll-Rand Diesel engine, direct connected to a 250 volt generator, developing 270 kilowatts at 265 revolutions per minute and a 40 kilowatt, 125 volt exciter. The propulsion motors will each develop 950 horsepower at 180 revolutions per minute.

The Ingersoll-Rand Company also supplied the engines for the first three Diesel-electric ferryboats of this fleet.

The Westinghouse variable voltage system of control will be used, whereby all speed control and maneuvering is accomplished by varying the separately excited shunt fields of the main generators.

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Todd Drydock Co. to Do Repair Work on Coast Guard Cutter Seneca

THE United States Coast Guard, Washington, D. C., has awarded a contract to the Todd Drydock, Engineering and Repair Corporation, Brooklyn, New York, for repairing and reconditioning the cutter *Seneca*. Bids for the work were received by the Construction and Repair Department of the Coast Guard, at Washington, on Monday, September 12.

The work includes the reconditioning of hull and machinery, new piping and electric wiring throughout, the renewal of the main decking, rearrangement of quarters for warrant officers and enlisted personnel, improvement of the hospital space, radio room and toilet facilities. The bridge will be enclosed and the vessel will have one mast instead of two. In general, it is planned to bring the condition of the vessel up-to-date.

Shipping Board Adopts Resolution Designed to Protect Shipping Interests

STEPS to safeguard American shipping against foreign competition were taken when the Shipping Board at a recent meeting adopted a resolution looking to the development of marine agents and operators with undivided interests. The resolution read:

Resolved, That on and after November 1, 1927, no managing operator or agent shall continue to be, or be, contracted with as such by the United States Shipping Board Merchant Fleet Corporation who operates either as agent, owner or charterer of foreign-flag vessels competing either directly or indirectly with lines operated by or for the United States Shipping Board.

Tams and King Naval Architects Ask Bids for Diesel Yacht

ESTIMATES are being asked from a number of eastern shipyards by the firm of Tams and King, naval architects, New York, for the construction of a Diesel yacht which is to have a length of about 210 feet. It is understood that plans and specifications were issued a short time ago for the work, but no definite date of opening the bids has as yet been announced. The principal for whom the yacht is to be built is not known at this time.

Specifications Issued for 340-Foot Diesel Yacht

IT is understood that plans and specifications have been issued by Henry J. Gielow, Inc., naval architects, New York, for the construction of a Diesel yacht which is to have a length of about 340 feet. Although no specific information is yet available on the name of the principal for whose account the yacht is to be built, it is believed that it may be for Colonel Green. Power is to be supplied by two 1,500 horsepower Diesel engines. Further details will be available shortly.

Mexican Government to Negotiate for Construction of Two Passenger and Freight Ships in American Yards

INSTRUCTIONS have been received by the Mexican Consul General, New York, to open negotiations for the construction in American yards of two 5,000-ton passenger and freight steamers, one of which is to be operated by the National Navigation line between San Francisco and the West Coast of Mexico and the other between North Atlantic and Gulf ports.

Philadelphia and Reading R.R. Will Issue Plans for Diesel Tug

INFORMATION has been received that the Philadelphia & Reading Railroad, Philadelphia, Pa., is having plans and specifications prepared for the construction of a Diesel tug boat. No definite date has as yet been settled upon for issuing specifications but it is believed that they will be out shortly. The boat is to be equipped with a 450 or 500 horsepower Diesel engine. No further particulars are as yet available.

Collision Repairs to S.S. San Giuseppe

A CONTRACT for temporary repairs to four plates on the starboard side of the Italian steamship *San Giuseppe*, which was in collision with the British steamship *Dryden* recently, off Overfalls lightship, has been awarded to the Pioneer Iron Works, 149 Pioneer street, Brooklyn, New York. The price involved was not given out.

Plymetl Doors Found Advantageous on Board Ship

THE Manitowoc Ship Building Corporation, Manitowoc, Wis., which has built a number of large ferries with Plymetl doors, states that Plymetl doors "are very satisfactory and a great improvement over the usual wooden door. The chief trouble with wood doors on ships is that they are affected by the atmosphere and will warp, jam, shrink, and so on. Plymetl doors have completely eliminated these troubles, and we have had nothing but expressions of satisfaction from owners for whom we have installed them."

In an article on Plymetl, Mr. Horace Holden Thayer, naval architect of Philadelphia, has outlined the merits of this material concisely, as follows:

"The faces are thin and offer little resistance to the cutting of the material, driving of screws, etc., and the use of metal eliminates all possibility of checking with consequent disfigurement of the paint coating. The material is of particular value in locations where its fire-resistant features are an important consideration and of particular value also in locations where its sanitary and non-absorbent features are an important consideration.

"The material is very much stiffer than steel plates; it can, therefore, like the plywood, be used without backing."

Plymetl is the product of the Haskelite Manufacturing Corporation of Chicago.

President Coolidge Favorable to Upbuilding of American Fleet

IN discussing the recent proposals of Edward N. Hurley, former chairman of the Shipping Board, that the railroads take over the operation of the shipping lines, President Coolidge expressed the idea that the indifference of American business to the merchant marine is the chief difficulty obstructing the development of the American owned and operated fleet. If shippers and purchasers in the United States would insist upon the use of American bottoms in transporting their goods, it is believed, a long step forward would be taken in clearing up the troublesome merchant marine problem.

Mr. Coolidge is said not to be prepared to make a decision on Mr. Hurley's proposition but feels that it would stimulate American interests in the use of their own shipping services.

The recognition of President Coolidge at this time to the acuteness of the shipping problem and his willingness to listen to proposals tending towards the improvement of conditions indicates the possibility of some definite action being taken by Congress at the next session on the Merchant fleet problem.

With the President and Congress well disposed towards establishing a constructive policy for upbuilding our shipping facilities, it would seem that the various bodies directly interested in the matter should make a concerted move to obtain legislative support. General A. C. Dalton, president of the Merchant Fleet Corporation, has announced his intention of submiting to Congress a program of ship construction that would make more equal our standing in foreign trade. Details of his report will of course not be available for some time but as a result of his recent survey of foreign shipping it is believed that he will propose the building of fast freighters and transatlantic liners that will give this country a fair share in the handling of its own products and in transporting its own citizens.

Bethlehem Corp. Intercoastal Service Inaugurated

THE first sailing under the new organization of intercoastal service by the Calmar Line was inaugurated from Baltimore September 2 and was followed on September 10 by a sailing from Philadelphia. The announcement of the service was recently made by the Moore and McCormack Company, general agents, for the Calmar Steamship Corporation, which has been organized with the backing of the Bethlehem Steel Corporation to represent it in this trade.

Shipping Board Tanker Operation

THE United States Shipping Board has transferred the operation of its tanker fleet to the operating department of the Merchant Fleet Corporation, instead of having the vessels allocated to outside operators as heretofore. The vessels are used mainly for the transportation of fuel oil for the use of the vessels of the Merchant Fleet Corporation.

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Anaconda Copper Company Subsidiary Orders Another Ellis Channel Steel Barge

THE New York and Hastings Steamboat Company, a subsidiary of the Anaconda Copper Company, has under construction by the Midland Barge Company, at Salisbury, Md., its second deck barge built under the Ellis channel system of steel hull construction. The deadweight capacity will be 900 tons.

Channels of 12-inch section will be used as in the first Ellis steel barge built for this owner. The steel is being fabricated at Midland, Pa. The dimensions are: length, 115 feet; width, 34 feet; depth, 9 feet 11 inches amidships.

The barge will have a cambered wooden deck 4 inches thick with a 6-inch camber, calked and payed with pitch. There will be three lines of fore and aft trussed girders with diagonal bracing at every frame extending from the gunwale to the bottom of the barge, port and starboard. There will be six heavy cross braces extending completely across the ship. A heavy steel side rubbing plate will extend all fore and aft, and will be flanged over the gunwale to a large radius to prevent chafing of lines. There will also be heavy steel corner castings and a heavy rubbing plate at mid depth all fore and aft. The owner's design of babbitted cleats and chocks will be used throughout. The hull will be specially ventilated. For living quarters there will be provided a two-cabin house lined with wood.

This is the forty-first hull to be built under the Ellis channel system of steel hull construction. The naval architect is W. R. Esmond.

Bids Being Asked on Several Ocean Going Yachts

THE latest addition to information on contemplated yacht work is the announcement that bids are being received by the firm of Henry J. Gielow, Inc., naval architects, New York, for the construction of a twin screw yacht which will have a length of about 240 feet. The machinery in this case will consist of two 1,100 horsepower geared turbines.

Reviewing and correcting previous information on other yachts for which bids are being taken, the following information has become available: The firm of Henry J. Gielow, Inc., is asking bids for one 340-foot direct drive Diesel yacht which is to be equipped with three 1,500 horsepower Bessemer Diesel engines.

The same firm is also receiving bids on one 310-foot turbo electric drive yacht.

John H. Wells, naval architect, New York, is receiving bids for one Diesel yacht about 120 feet in length which will be equipped with two 300 horsepower Winton engines.

The firm of Tams & King, naval architects, New York, will soon open bids on one Diesel yacht having a length of about 125 feet which is to be fitted with two 250 horsepower Winton engines.

Theodore Wells, naval architect, New York, is asking bids on a turbo electric yacht which will have a length of 240 feet.

In addition to the above, several of these firms, as well as the firm of Cox & Stevens, naval architects, have under preparation specifications or are receiving bids on a number of smaller yachts, information for which will be available at a later date.

S.S. Eastern Temple May Be Sold to High Seas Transportation Co.—Reconditioning Will Be Needed

AN agent of the High Seas Transportation Company of New York was recently in Norfolk to inspect the American steamship *Eastern Temple*, which that corporation probably will purchase from the Shipping Board. The vessel, which is of 5,500 tons deadweight, is now at the plant of the Norfolk Shipbuilding and Dry Dock Company, where she will be surveyed to determine the amount of work necessary to recondition her for service. She is to be placed in the coastal trade provided she is purchased by the High Seas Transportation Company.

S.S. Minnequa Collides with Brooklyn Bridge Tower—Extensive Repairs Necessary

THE steamship *Minnequa* recently purchased from the Shipping Board by Moore and McCormack Company, Inc., New York, smashed into the New York tower of Brooklyn Bridge recently crushing in her bow plates. It is believed that the vessel suffered damage to the extent of $30,000 or $40,000. She is now in dock waiting repairs. The vessel was one of the six sister ships that figured in the American Scantic fleet sale last week.

Further Barges for Standard Unit Nav. Co. Not to Be Built Until Next Year

AN ANNOUNCEMENT was made in these columns recently, that tenders would soon be taken by the Standard Unit Navigation Company, 408 Pine street, St. Louis, Mo., for 20 additional steel barges, but according to official information received, no additional contracts will be let until next year. The Standard Unit Navigation Company was chartered last year at St. Louis, Mo., with a capitalization of $10,000,000, for the purpose of operating towboats and barges.

Trials of Steamship Mercer Will Be Held at New York

AT THE recent meeting of the Fuel Conservation Committee of the United States Shipping Board it was proposed that the board should arrange to have the eight-hour trial run of the pulverized coal-burning steamer *Mercer* held off New York harbor in order to give interested shipping men a good opportunity to observe the operation of the vessel with the new fuel. The work of installing the pulverized coal-burning equipment is making rapid progress and is expected to be completed about the middle of October.

Oriental S.S. Company May Purchase Pioneer Line

THE Shipping Board recently informed Oakley Wood, president of the Atlantic, Gulf and Oriental Steam Ship Company that it would be willing to negotiate for the sale to him of the former American Pioneer line. This action is in pursuance of the recent re-arrangement of the American Pioneer Line into separate North Atlantic and Gulf divisions.

Worthington Corporation Concentrates Diesel Engine Construction at Enlarged Buffalo Plant

ACCORDING to President Belnap of the Worthington Pump and Machinery Corporation, New York, the transfer of certain types of Diesel engine construction from the recently closed Blake and Knowles plant at Cambridge, Mass., to the newly enlarged Snow works in Buffalo, N. Y., is the latest step in his policy of concentrating facilities for increased efficiency in economical operation.

For the last two years the Snow plant has been expanding and modernizing to prepare for this transfer. The Snow plant is now completely renovated. The best of the Cambridge plant equipment has been moved in and installed in space newly provided. To meet the demand for additional power, a large new power plant has been built. Extra tracks laid in the yard serve the recently enlarged storage and shipping facilities. The foundry has been modernized, the machine shops equipped with many new machines and additional cranes of the latest design. To test the corporation's Diesel and gas engines of the various types and sizes the most modern erection floors and test stands have been constructed. To assure effective supervision and inspection the corporation's Diesel engineering talent has also been concentrated at this plant.

The large double-acting Shipping Board Diesel engines were built at the Snow works. These engines, the first to be installed in the government's cargo ship conversion program, are, according to their operators, giving a good account of themselves in the motorships *Tampa* and *Unicoi*. Besides the concentration of the complete line of Diesels at this plant, there has been added the manufacture of a Diesel designed for fishing boats, small stationary and portable applications such as excavating shovels and hoisting rigs, and for driving small pumps and compressors.

Commenting on this greater plant, President Belnap said: "We are now in the enviable position of having at Buffalo one of the very best equipped and most efficient internal combustion engine shops in the country. Never in its history has Worthington been in a better position to make prompt deliveries in all sizes of oil and gas engines."

Canadian National Railways Orders Three Ships

THE Canadian National Railways, Windsor, Ont., Canada, has placed a contract with Cammell, Laird and Company of Liverpool, England, for the construction of three new vessels to operate on the eastern route between Canada and the British West Indies, at a total cost of $3,849,000. The three new vessels will provide a passenger, mail and freight service in accordance with the Canada-West Indies trade agreement of July, 1925. The first vessel will be completed within 13 months, the second within 14 and the third within 15.

Vessels for the western route will not be ordered for about three weeks, but negotiations are pending. The government was unable to give the contract to a Canadian firm, as the lowest Canadian tender was $6,820,000. Tenders for the construction of the five vessels were received and opened on September 1.

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Ship Construction and Repair Bids

Bids Received for Installation of Pulverized Coal Burning Equipment on S.S. Mercer

TENDERS for work in connection with the installation of coal pulverizing equipment and burners on the steamship *Mercer*, were received and opened at the office of Carl J. Jefferson, head of the Fuel Oil Conservation Section of the United States Shipping Board, 45 Broadway, New York, on Wednesday, August 31.

The bids received for the work were as follows:

Maryland Drydock Company	$36,498
W. and A. Fletcher Company	54,273
Federal Shipbuilding Company	56,280
Morse Drydock and Repair Company	66,995
New York Harbor Drydock Company, Inc.	75,000
Newport News Shipbuilding and Drydock Company	79,200
Sun Shipbuilding and Drydock Company	81,250
Staten Island Shipbuilding Company	82,500
Philadelphia Navy Yard	83,013
Robins Drydock and Repair Company	85,505
Bethlehem Shipbuilding Corporation, Ltd.	87,400

Salvage Bids for S.S. Juvigny

The United States Engineer Office, Schaff building, 1505 Race street, Philadelphia, Pa., received and opened tenders on August 26, 1927, for the removal of the steel freight steamship *Juvigny*, lying sunk in Delaware bay. Two proposals were received as follows:

NAME	PRICE BASED ON REMOVAL OF WRECK INTACT
Philadelphia Derrick and Salvage Corporation, Pier 17, North Wharves, Philadelphia, Pa.	$ 67,440
Merritt-Chapman and Scott, Corporation, 17 Battery Place, New York City	120,000

The award of contract has not as yet been made.

Coast Guard Opens Bids to Modernize Cutter Seneca

BIDS were received and opened by the Construction and Repair Department of the United States Coast Guard, Washington, D. C., Monday, September 12, for the modernizing of the cutter *Seneca*. The work included reconditioning of the hull and machinery, new piping and electric wiring throughout, the renewal of the main decking, rearrangement of quarters for warrant officers and enlisted personnel, improvement of the hospital space, radio room and toilet facilities. The bridge will be enclosed and the vessel will have one mast instead of two. In general, it is planned to bring the condition of the vesse' up to date.

The bids received for the work are as follows:

Todd	$149,800
Charleston D. D.	166,805
Philadelphia Navy Yard	172,000
Newport News	174,700
Morse	188,950
Federal	195,000
Staten Island	19,600
Bethlehem	271,190

United States Engineers Open Bids for Steel Barges

BIDS were opened Tuesday, September 13 by the United States Engineer Office, Milwaukee, Wis., for the construction of two steel barges. The following bids for the work were received:

Bidder	Plate Construction	Channel Construction
Milwaukee Shipbuilding Corp.	$23,330	$20,140
Milwaukee Bridge Company	28,450	.....
Sturgeon Bay Shipbuilding & Dry Dock Co.	23,800	.....
Lakeside Bridge & Steel Co.	23,680	24,870
Marine Iron & Shipbuild'g Co.	22,200	.....
Leatham D. Smith Dock Co.	21,800	20,800

No award has as yet been made for the work.

Repair Bids for Str. Bombay

PLANS and specifications were recently prepared and issued by Frank S. Martin & Son, naval architects, 25 Broadway, New York, for the repair of machinery damage to the steamer *Bombay* owned by the Delaware & Hudson Steamship Company, 24 State Street, New York. A contract for the work was awarded to the Todd Shipbuil'ding & Dry Dock Company, Brooklyn, New York. The following bids were received:

Bidder	Contract price	Crank web	Time
Todd	$2,995	985	12
Robins	3,210	1,025	12
T. & L.	3,650	1,107	14
Morse	3,680	1,350	20
Staten Island Ship.	4,000	1,450	22

Contracts for Lighthouse Dept. Material

CONTRACTS for the furnishing and delivery of various types of buoys and appendages were awarded by the Superintendent of Lighthouses, Third District, Staten Island, New York, as follows:

Witt Steel Company, 7 bell buoys at $710 each.

Peter Jensen and Company, can and nun buoys, at a total price of $9,100.

Bressler Sheet Metal Works, special class welded buoys, at a total price of $13,638.75.

McCann Manufacturing Company, sinkers and balls, at a total price of $9,277.50.

Bids for the work were received and opened at Staten Island on August 3.

Dravo Co. Low Bidder for Building Floating Hoist

WITH a price of $29,800, the Dravo Contracting Company, Pittsburgh, Pa., submitted the lowest proposal for furnishing all labor and materials and constructing and delivering one floating A-frame hoist, bids for which were received by the United States Engineer Office, Louisville, Ky., on Monday, September 19. Seven other tenders were received as follows:

Name	Price
Howard Shipyards and Dock Company	$33,247
Midland Barge Company	35,750
Charles Ward Engineering Works	37,520
Zier Boiler and Sheet Iron Company	41,384
Dubuque Boat and Boiler Works	43,000
Nashville Bridge Company	43,340
Charles Hegewald Company	44,900

The award has not as yet been made.

Repair Bids for Munson Line S.S. Munomo

PLANS and specifications were issued early last month by Frank S. Martin and Son, naval architects, New York, for repairs to the steamship *Munomo*, owned by the Munson Steamship Line, New York. Bids for the work were opened Thursday, September 8, at the Munson Line offices with the following results:

Firm name	Amount	Time, days
W. & A. Fletcher	$7,813	9
Morse	8,995	10
Robins	9,400	10
New York Harbor	9,880	12
Staten Island Ship	10,500	12

The award for the work has not as yet been announced.

Robins Yard to Repair S.S. Dundrennan

FRANK S. MARTIN AND SON, naval architects, 25 Broadway, New York, prepared plans and specifications for the account of the London Salvage Company, New York, covering collision damage to the steamship *Dundrennan*. Bids were opened Tuesday, September 6, the contract for the work being awarded to the Robins Dry Dock and Repair Company, Erie Basin, Brooklyn, N. Y., at a price of $5,500 and a time of 5 days. Other bids received were as follows:

Firm name	Amount	Time, days
Shewans	$4,994	10
Morse	5,100	8
Staten Island Ship	8,958	12
New York Harbor	10,465	11

Staten Island Shipyard to Convert Two Ships from Coal to Oil Burning

IT is understood that C. L. Dimon, 24 State Street, New York, has awarded a contract to the Staten Island Shipbuilding Company, Staten Island, New York, for converting the steamships *West Mount* and *West Helix* from coal to oil burning. These vessels were purchased from the Shipping Board a short time ago.

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Notes from the Great Lakes

Lake Shipyards Busy with Repair Work

GREAT LAKES shipyards report an unusual amount of repair and other general work for the end of September. Quite a number of the big bulk freighters are laid up at ports from Duluth to Buffalo. The American Shipbuilding yards in Cleveland, Lorain and elsewhere are busier than usual, and the yards of the Great Lakes Engineering Works in Detroit and the yards in Toledo and Buffalo all have more work in hand than usual during the last week of September.

Conditions for late fall work are promising, according to shipyard superintendents.

Increased demand for vessels for handling grain shipments is bringing out some of the big freighters which have been idle for several weeks.

The peak of the coal movement has been passed, and, while the shipments continue heavy, they will gradually dwindle from now until the close of navigation.

Passenger boat service on the lakes has been curtailed to a considerable extent and pleasure boats in most instances have been discontinued.

American Shipbuilding Company Has Profitable Year

THE American Ship Building Company, Cleveland, Ohio, in its twenty-eighth annual report just issued, states that the year ending June 30, 1927, was the best year it has experienced since the war period. This year showed profits totaling $1,747,373 equal, after preferred dividends, to more than $11.50 a share on 147,144 shares of common stock.

President A. J. Smith in his message to stockholders states that the profit earned during the year was largely attributable to the volume of business in contracts for new tonnage. The volume of ship repairs and the resulting profits were, comparatively speaking, normal, although the number of vessels docked during the year was greatet than during the previous year. The new tonnage constructed by the company during the year comprised five bulk freight steamers, one large self-unloader, all of 600 feet in length or over and one tug.

"We have recently closed contracts for the construction of 2 oil-carrying vessels for operation on the Great Lakes, these vessels being scheduled for delivery during the spring and summer of 1928," says Mr. Smith. "We have also just completed the construction of 2 oil-carrying barges for use in New York harbor and vicinity. There appears to be some interest in additional new tonnage as manifested by requests made of us to submit proposals.

"Due to a lack of demand for available tonnage on the Great Lakes, the season in shipping thus far has not been encouraging. While it is possible for the remaining three months of navigation to show some improvement, it is the general opinion of ship operators that, on the whole, the season will not be as lucrative as the one preceding. While operating conditions do not always measure the prosperity which we may enjoy, they nevertheless indicate that, at this time, we should not anticipate any more than a normal ship repair business during the fiscal year just begun.

"The expenditures made during the year for plant additions and betterments amounted to $174,481.58. These cash outlays were chiefly for facilities required at our Lorain and Chicago yards.

"We are replacing our wooden docks fronting on the river at Buffalo with concrete and we are carrying on extensive repairs to the dry docks at that yard. Upon the completion of this work and the revamping which is being carried on at our South Chicago yard, all our active properties will be in excellent condition. The revamping of our yard at South Chicago is progressing without interfering with general business and will be completed in time to more efficiently take care of the coming winter's work.

"During the year we sold the remaining eight Type Eleven ships. The price obtained exceeded the book value at June 30, 1926, by $59,382.81. The sale of these ships will effect a saving of the carrying charges which would otherwise be incurred."

Lake Carriers' Schools Open on January 4

THE welfare plan committee of the Lake Carriers' Association announces that the classes in navigation and marine engineering at Cleveland and Marine City will open on Wednesday, January 4, 1928.

In order that all prospective students, particularly those on steamers that will lay up early with storage grain, may receive an application for enrollment, the blanks will this year be sent to the boats in the envelopes that will contain the September issue of the *Bulletin*.

Those holding registration in the welfare plan in good standing will be eligible to attend the school and no tuition charge will be exacted. The seaman who intends to take the course for the purpose of obtaining an original license must understand that to qualify for an examination the regulations of the Steamboat Inspection Service require that he shall be a citizen of the United States, shall have served twenty-four months in the deck department of a lake vessel if a candidate for a pilot's license, or thirty-six months in the engine department if a candidate for an engineer's license.

Chicago Marine Hospital Closed for Repairs

GEORGE A. MARR, secretary of the Lake Carriers' Association, has issued a bulletin saying that the Marine Hospital in Chicago has been closed temporarily for repairs. While it is closed patients will be sent to 536 Lake Shore Drive for admission, or, after hours, they will be received at the Augustana hospital 2043 Cleveland avenue, Chicago.

Record Cargo of Stone

THE steamer *L. E. Block* of the Inland Steamship Company, August 29, carried a record cargo of stone to Indiana Harbor. The cargo consisted of 15,622 gross tons. She was built at the Lorain yards of the American Shipbuilding Company, is 596 feet long, 64 feet beam and 33 feet deep and came out at the opening of this season.

Calumet Shipyard Organized at Chicago

A NEW company, known as the Calumet Shipyard and Dry Dock Company, has been organized to carry on work of ship repairing and boat and yacht storage at South Chicago on the site which was formerly occupied by the Kraft Shipyard and Dry Dock Company at 94th street and Calumet river. An entirely new line of machinery will be installed in the plate shop, machine and carpenter shops. An electric welding outfit and other modern equipment will be added.

Additional Vessels Placed in Grain Service

A STEADY increase in the downbound movement of grain on the lakes has led to the several freighters which have been idle at Buffalo all season being pressed into service. The steamers *J. J. H. Brown, W. H. Truesdale, W. P. Palmer,* and three others have been out into the grain hauling service. These vessels had not turned a wheel this season until ordered out to aid in moving the heavy northwestern grain crop. The steamer *Utica* which has also been laid up at Buffalo has been equipped with an elevator for handling automobiles.

Goes Into Winter Quarters

THE first lake ship to go into winter quarters in the Lorain harbor was the *McDougall* operated by the Pittsburgh Steamship Company. The ship docked on September 14. Lorain, it is reported, will winter an unusually large number of vessels during the coming winter.

A second vessel, the *Maumaloa,* also owned by the Pittsburgh Steamship Company, docked there a day later.

The passenger steamer *Seeandbee* of the Cleveland and Buffalo Transit Company, made its last trip between Buffalo and Cleveland on September 14 and is now docked at the East 9th street pier, Cleveland, for the winter. The steamers *City of Erie* and *City of Buffalo* will continue to operate between the two cities until November 15.

Second Standard Oil Barge Launched

THE 250-foot oil barge which was launched at the Lorain yards of the American Shipbuilding Company last month has been named the *Socony No. 111.* She is a sister ship of the *Socony No. 112* launched at the same yards several weeks ago. The carriers are being built for the Standard Oil Company of New York.

Marine Mishaps

The steamer *Ralph Budd* went ashore at Pine River shoal near Huron Island but was released after she had lightered most of her cargo. Two tugs and the lighter *Reliance* of the Great Lakes Towing Company worked to release the ship.

The steamer *E. S. Clarke* downbound went aground below the entrance to West Nebish channel in Hay Lake. Her cargo had to be lightered before she could be released.

The steamers *Bay State* and *Martin Mullen* were in collision at Southeast Bend. The *Bay State* had several plates damaged and was sent to a shipyard for repairs.

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TRADE PUBLICATIONS

HIGH EFFICIENCY PUMPS.—A folder announcing the availability of high efficiency pumps for general service, which are being manufactured by the Worthington Pump & Machinery Corporation, New York, has recently been issued. It is claimed that these pumps give efficiencies 8 to 10 points higher than the average for centrifugal pumps.

PYROMETERS.—The Pyro radiation pyrometer, to be used to measure temperatures exceeding 1,000 degrees Fahrenheit, is described in bulletin No. 20 prepared by the Pyrometer Instrument Company, New York city. This pyrometer is used in connection with controlling, firing and heat treating operations by a continuous measurement of temperature.

RECORDING AMMETERS.—A new type recording ammeter, made by the Bristol Company, Waterbury, Conn., is described in a catalogue recently issued by this company. The ammeter is used to record a complete story of current conditions in connection with power and lighting circuits, sub-station buses, transformers, motors, electric furnaces, ovens, and the like.

AUTOMATIC FIRE DETECTION.—The Garrison Fire Detecting System, New York, has issued a new booklet containing a description of the automatic fire detecting wire produced by this company and an outline of the various applications which can be made by means of the system. A section of the booklet is devoted specifically to marine installations of this apparatus.

SMALL TOOLS AND MACHINERY.—Joseph T. Ryerson & Son, Inc., Chicago, has issued a catalogue giving illustrations and general characteristics of Ryerson metal working small tools and machinery. This equipment covers a wide range of uses in practically all metal working industries from drills, wrenches, reamers and the like up to heavy machine tools of various types.

THE STAR CONTRA RUDDER.—A bulletin on the Star contra rudder has been issued by James Pollock Sons & Company, Ltd., London, England, which contains photographs and diagrams of a typical installation of this rudder. A list of vessels on which it has been installed up to May, 1927, is included. This rudder is a combination of the Star contra propeller and stream line rudder.

WELDED ROOF TRUSSES.—A booklet consisting of a report of the design, development, fabrication and testing of a series of oxyacetylene welded roof trusses of the Fink type has been published by the Linde Air Products Company, New York. This book is designed to make available information on the design, fabrication procedure and ultimate strength of a series of 40-foot roof trusses to all those engaged in structural and welding work.

GENERAL ELECTRIC BULLETINS.—The General Electric Company, Schenectady, New York, has recently issued the following bulletins describing the squirrel cage general purpose constant speed motors designated as the "500 Series"; adjustable varying speed motors; general purpose synchronous motors; adjustable speed alternating current brush shifting motors; vertical type induction motors; totally inclosed induction motors; metal melting pots and equipment for this apparatus; air heating units; jack type disconnecting switches; motor starting switches and air compressor governors.

MOTORSHIP DISKO.—The Arctic motorship *Disko*, which belongs to the fleet of the Royal Danish Greenland Trading Company, Copenhagen, is the subject of a reprint from *The Shipbuilder* which has been issued by Burmeister and Wain, Ltd., Copenhagen, Denmark, in the form of a folder. The motorship *Disko* was the first ship of the type to be placed in Greenland service and since her maiden voyage this spring she has made four voyages to and from Greenland. The reprint is excellently illustrated with photographs of the machinery which consists of a Burmeister and Wain standard type, 6 cylinder, single acting, four stroke cycle, reversible Diesel engine developing 1,050 indicated horsepower at about 120 revolutions per minute.

BUSINESS NOTES

The Diehl Manufacturing Company, Elizabeth, N. J., has just appointed E. V. Winter, 215 Market street, San Francisco, Cal., as western agent for Diehl equipment.

Moore and McCormack, Inc., 5 Broadway, New York, general agents for the Calmar Steamship Corporation, will open their own office in Baltimore in connection with the new intercoastal service soon to be established. The Baltimore office will be in charge of John Sonderman, who has had long experience in Baltimore shipping.

The Bessemer Gas Engine Company, Grove City, Pa., has been awarded the contract for two 125-150 horsepower direct reversible marine engines for the New Orleans inspection boat for the U. S. Army engineers. The boat will be built at Charleston, W. Va., by the Chas. Ward Engineering Works.

T. F. Barton of the central station engineering department of the General Electric Company at Schenectady has been appointed engineer of the New York district, with headquarters at 120 Broadway, New York. J. B. Bassett of the New York office has been named executive engineer of the New York district.

The Westinghouse Electric International Company has just announced the establishing of a new branch to be known as the Compania Electrica Westinghouse de Chile, with activities in the countries of Chile and Bolivia. Mr. E. L. McCloskey, formerly manager for China of the Westinghouse Electric International Company, has been appointed manager of the new branch with headquarters at Santiago, Chile.

The Royal Belgian Lloyd of Antwerp, after having tried the Oertz rudder on three of their steamers of 4,155 tons deadweight, have just ordered it for six new steamers of 9,500 tons deadweight. The Van Nievelt Goudriaan Steamship Company of Rotterdam, after having tried the Oertz rudder on the S. S. *Alderamin*, are now putting it on two new steamers being built by William Gray & Company at West Hartlepool, England, measuring 9,000 tons deadweight.

Marine Societies

America

American Marine Association. 30 Church St., New York. President—Col. E. A. Simmons.

American Marine Standards Committee. Chairman, Colonel E. A. Simmons. Secretary, A. V. Bouillon, Division of Simplified Practice, Department of Commerce, Washington, D. C.

American Society of Marine Designers. Secretary—B. G. Barnes, 202 Kendrick Ave., Quincy, Mass.

American Society of Marine Engineers. 605 Market St., San Francisco, Calif. President—Henry F. Gelhaus. Secretary—Wm. H. Thille.

American Society of Naval Engineers. Navy Department, Washington, D. C. Secretary-Treasurer—Commander H. B. Hird, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

American Steamship Owners' Association. 11 Broadway, New York. President—H. B. Walker.

Atlantic Coast Shipbuilders' Association. 1600 Walnut Street, Philadelphia, Pa. Secretary—C. S. King.

Council of American Shipbuilders, Inc., 50 Broadway, New York. President—Homer L. Ferguson. Secretary-Treasurer—Henry C. Hunter.

Jersey Marine Club, 4th and River streets, Hoboken, N. J. President—Col. Bartlett.

Lake Carriers' Association. President—J. S. Ashley. Secretary—George A. Marr, Rockefeller Building, Cleveland, O.

National Association of Engine and Boat Manufacturers. 29 West 39th Street, New York City. Secretary—Ira Hand.

National Association of Masters, Mates and Pilots. National Secretary—M. D. Tenniswood, 308 Vine St., Camden, N. J.

National Marine Engineers' Beneficial Association. Headquarters, 311-315 Machinists Building, Washington, D. C. President—Wm. F. Yates. Secretary—Albert L. Jones.

National Merchant Marine Association. Munsey Bldg., Washington, D. C. President—Hon. J. E. Ransdell.

Neptune Association. 21 Pearl St., New York City. Secretary-Treasurer—Captain John F. Milliken.

New York and New Jersey Dry Dock Association, 111 Broadway, New York. President—Jonathan Moore.

Ocean Association of Marine Engineers. 15 Whitehall St., New York. Secretary—Bert L. Todd.

Port of New York Authority. 75 West Street, New York. Chairman—George S. Silzer. Secretary—Wilson J. Vance.

Society of Naval Architects and Marine Engineers. 29 West 39th Street, New York. Secretary and Treasurer—Daniel H. Cox.

The Maritime Association of the Port of New York. 78 Broad St., New York City. President—John Dowd. Secretary—John F. Manning.

The New York Tow Boat Exchange. 11 Moore St., New York. Manager—Langdon W. Smith.

The Propeller Club of the Port of New York. President—Harry W. Parsons, 111 Broadway, New York. Secretary—W. Z. Gardner, 136 Liberty street, New York.

United States Naval Institute. Naval Academy, Annapolis, Md. Secretary and Treasurer—Captain H. A. Baldridge, U. S. N.

United States Ship Operators' Association. 149 Broadway, New York. President—Winchester Noyes.

Canada

Grand Council N. A. of M. E. of Canada. Grand Secretary-Treasurer—W. A. MacDonald, 62 Albert St., Halifax, N. S.

Great Britain

Institute of Marine Engineers, Incorporated. 85/88 The Minories, London, E.1.

Institution of Engineers and Shipbuilders in Scotland. 39 Elmbank Crescent, Glasgow.

Institution of Naval Architects. 5 Adelphi Terrace, London, W. C.

North East Coast Institution of Engineers and Shipbuilders. Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

France

Association Technique Maritime et Aéronautique. Secrétariat Général—7, rue de Madrid, Paris (8e).

Italy

Collegio Degli Ingegneri Naval e Meccanici in Italia.

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